Supreme Court, U.S.
FILED

001426 MAR 13 2001

OFFICE OF THE CLERK

No.

In the Supreme Court of the United States

SOUTHERN CALIFORNIA EDISON COMPANY
Petitioner,

vs.

ECOLOCHEM, INC.,
Respondent.

On Petition for a Writ of Certiorari to the United States Court of Appeals for the Federal Circuit

PETITION FOR A WRIT OF CERTIORARI

Gregory P. Stone
Ted G. Dane
Counsel of Record
Jonathan R. Levey
MUNGER TOLLES & OLSON LLP
355 S. Grand Avenue, 35th Floor
Los Angeles, CA 90071-1560
(213) 683-9100
Counsel for Petitioner Southern California Edison Company

Bowne of Los Angeles, Inc., Law Printers (213) 627-2200

223 pp

QUESTION PRESENTED FOR REVIEW

1. Whether the Federal Circuit misinterpreted and unduly limited section 103 of the Patent Act of 1952 ("Patent Act") in reversing the trial court's obviousness judgment because Petitioner did not prove, by clear and convincing evidence, an element not required by section 103 – namely the existence of a specific source, at the time of the invention, of a suggestion to combine the teachings of the prior art in the manner of the invention.

PARTIES TO THE PROCEEDINGS

The names of the parties to the proceeding for which review is sought are contained in the caption of the case.

RULE 29.6 STATEMENT

The parent companies of the Petitioner and publicly-traded companies owning 10% or more of its stock are:

Edison International – parent of Southern California Edison Company

TABLE OF CONTENTS

Page

QUESTION PRESENTED FOR REVIEW i

PARTIES TO THE PROCEEDINGS ii

RULE 29.6 STATEMENT iii

TABLE OF AUTHORITIES ..... v-ix

PETITION FOR A WRIT OF CERTIORARI 1

OPINIONS BELOW 1

JURISDICTION 1

CONSTITUTIONAL AND STATUTORY PROVISIONS INVOLVED 1

STATEMENT 2

REASONS FOR GRANTING THE WRIT 6

I. THIS COURT SHOULD GRANT CERTIORARI TO DETERMINE WHETHER THE SUGGESTION REQUIREMENT IS AN ESSENTIAL ELEMENT OF SECTION 103 7

II. THIS CASE IS WELL-SUITED FOR CERTIORARI, BECAUSE ELIMINATION OF THE SUGGESTION ELEMENT HERE REQUIRES REVERSAL OF THE FEDERAL CIRCUIT'S JUDGMENT 24

CONCLUSION 30

TABLE OF AUTHORITIES

Page(s)

CASES

Anderson's-Black Rock v. Pavement Co., 396 U.S. 57, 61 (1969) 12

Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281 (Fed. Cir. 1985) 18

Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141 (1989) 7, 22

C.R. Bard, Inc. v. M3 Sys., Inc., 157 F.3d 1340, 1352 (Fed. Cir. 1988) 2, 20

Chore-Time Equipment, Inc. v. Cumberland Corp., 713 F.2d 774, 781 (Fed. Cir. 1983) 15

Day v. Fair Haven & W. Ry. Co., 132 U.S. 98 (1889) 8

Diamond v. Diehr, 450 U.S. 175 (1981) 3

Expanded Metal Co. v. Bradford, 214 U.S. 366 (1909) 8

Graham v. John Deere Co., 383 U.S. 1 (1966) 2, 25, 28, 29

Great A. & P. Tea Co. v. Supermarket Corp., 340 U.S. 147, 155, 153 (1950) 11

Hotchkiss v. Greenwood, 52 U.S. 248 (1851) 8, 9

In re Avery, 518 F.2d 1228 (C.C.P.A. 1975) 11

TABLE OF AUTHORITIES
(continued)

Page(s)

In re Beattie, 974 F.2d 1309, 1312 (Fed. Cir. 1992).....18

In re Brouwer, 77 F.3d 422, 425 (Fed. Cir. 1996).....20

In re Dalzell,
152 F.2d 1013, 1014 (C.C.P.A. 1946) 10

In re Eli Lilly & Co.,
902 F.2d 943 (Fed. Cir. 1990).....6

In re Farrenkopf,
713 F.2d 714 (Fed. Cir. 1983).....26

In re Fine,
837 F.2d 1071 (Fed. Cir. 1988).....18

In re Fridolph,
134 F.2d 414 (C.C.P.A. 1943) 10

In re Fritch,
972 F.2d 1260 (Fed. Cir.1992).....17

In re Gorman,
933 F.2d 982 (Fed. Cir. 1991).....17, 25

In re GPAC, Inc., 57 F.3d 1573, 1581 (Fed. Cir.
1995) 18

In re Hortman,
264 F.2d 911, 914 (C.C.P.A. 1959) 11

In re Imperato,
486 F.2d 585 (C.C.P.A. 1973) 13

In re Micro Chemical, Inc. v. Great Plains Chemical Co., Inc.,
103 F.3d 1538 (Fed. Cir. 1997).....18

TABLE OF AUTHORITIES
(continued)

Page(s)

In re Milne,
140 F.2d 1003 (C.C.P.A. 1944) 16

In re Oetiker,
977 F.2d 1443 (Fed. Cir. 1992).....19, 20

In re Rinehart,
531 F.2d 1048 (C.C.P.A. 1976) 11

In re Scheckler,
438 F.2d 999 (C.C.P.A. 1971) 13

In re Sernaker,
702 F.2d 989 (Fed. Cir. 1983).....13, 14

In re Shaffer,
229 F.2d 476 (C.C.P.A. 1956) 10

Kansas Jack, Inc. v. Kuhn,
719 F.2d 1144 (Fed. Cir. 1983).....15

Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.,
730 F.2d 1452 (Fed.Cir.1984).....17

Mast, Foos & Co. v. Stover Mfg Co., 177 U.S. 485,
493 (1900).....15

Motorola Inc. v. Interdigital Technology Corp.,
121 F.3d 1461 (Fed. Cir. 1997).....18

Panduit Corp. v. Dennison Mfg.,
810, F.2d 1561, 1568 1 U.S.P.Q.2d 1593 (Fed. Cir. 1987) 17

Pentec v. Graphic Controls Corp.,
776 F.2d 309 (Fed. Cir. 1985).....27

TABLE OF AUTHORITIES
(continued)

Page(s)

Pro-Mold & Tool Co., Inc. v. Great Lakes Plastics, Inc., 75 F.3d at 1568, 1573 (Fed. Cir. 1996).....23

Sakraida v. Ag Pro, Inc., 425 U.S. 273 (1976).....12, 29

South Corp. v. United States, 690 F.2d 1368 (Fed. Cir. 1982).....12

Stratoflex v. Aeroquip Corp., 713 F.2d 1530 (Fed. Cir. 1983).....27

WMS Gaming, Inc. v. International Game Technology, 184 F.3d 1339 (Fed. Cir. 1999).....18

STATUTES

Patent Act of 1952, 35 U.S.C. § 103.....2

OTHER AUTHORITIES

John R. Allison and Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185(1997).....8

Donald Chisum, *Chisum on Patents*, (2000) 23

Irah H. Donner, *In re Beattie: Is The Obviousness Standard No Longer Obvious?*, 10 No. 4. Computer Law. 18 (April 1993).....20

Donald R. Dunner et al., 5 Fed. Circuit B. J. 151, 162, *A Statistical Look at the Federal Circuit's Patent Decisions: 1982-1994* (Summer 1995).....8

TABLE OF AUTHORITIES
(continued)

Page(s)

Alan P. Klein, *A Funny Thing Happened on the Way to the Non-Obvious Subject Matter Condition for Patentability on Its Way to the Federal Circuit* 6

Alan N. Littman, *Restoring the Balance Of Our Patent System*, 37 IDEA: J.L. & Tech. 545, 549 (1997).....8

Kathleen N. McKereghan, *The Nonobviousness of Inventions: In Search of a Functional Standard*, 66 Wash. L. Rev. 1061 (1991).....21, 22

Michael J. Pender, *Judicial Review of PTO Patentability: Determinations Under the Substantial Evidence Standard of Review*, 82 J. Pat & Trademark Off. Soc'y 431 (June 2000) 10,21

PETITION FOR A WRIT OF CERTIORARI

Petitioner Southern California Edison Company ("SCE") respectfully prays that a writ of certiorari issue to review the judgment of the United States Court of Appeals for the Federal Circuit in the appeal below.

OPINIONS BELOW

The opinion of the court of appeal (App., *infra*, 1a-38a) is reported at 227 F.3d 1361. The district court's findings of fact and conclusions of law (App., *infra*, 39a-126a) are unreported. A prior opinion of the court of appeals in this action (App., *infra*, 127a-143a), is unreported. The district court's earlier memorandum and order granting SCE partial summary judgment (App., *infra*, 144a-181a), is reported at 863 F. Supp. 1165.

JURISDICTION

The judgment sought to be reviewed was entered on September 7, 2000. (App., *infra*, 1a-38a). Petitioner timely filed a Petition for Rehearing and Rehearing *en banc*, which was denied by the Federal Circuit on December 13, 2000. (App., *infra*, 182a). This Court's jurisdiction is invoked under 28 U.S.C. § 1254(1).

CONSTITUTIONAL AND STATUTORY PROVISIONS INVOLVED

Article 1, section 8, clause 8 of the United States Constitution, provides in relevant part:

> The Congress shall have power . . . [t]o promote the Progress of Science and useful Acts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.

Section 103 of title 35, United States Code, provides:

> A patent may not be obtained though the invention is not identically disclosed or

> described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

35 U.S.C. § 103.

STATEMENT

The present Petition asks this Court to determine whether it is proper to require litigants asserting an obviousness defense under section 103 of the Patent Act to prove an element found nowhere in the language of the statute.

In *Graham v. John Deere Co.*, 383 U.S. 1 (1966), this Court identified three factual inquiries relevant to the section 103 defense: the level of ordinary skill in the art; the scope and content of the prior art; and the differences between the prior art and the invention. Since its inception, however, the Federal Circuit has read into section 103 of the Patent Act of 1952 a requirement found in neither the statute nor in *Graham*: the requirement that the challenger must prove, by clear and convincing evidence, the existence of some "suggestion, motivation, teaching or incentive" that would have led one of ordinary skill in the art to combine or modify the prior art in the manner of the invention (hereinafter, the "suggestion requirement"). Regardless of the strength of an invalidity showing based on the three *Graham* factors, the Federal Circuit will not invalidate a patent unless it finds that this additional element has been met. *See C.R. Bard, Inc. v. M3 Sys., Inc.*, 157 F.3d 1340, 1352 (Fed. Cir. 1998)

(suggestion to combine prior art references is "essential evidentiary component of an obviousness holding").

This Court has "more than once cautioned that 'courts' should not read into the patent laws limitations and conditions which the legislature has not expressed." *Diamond v. Diehr*, 450 U.S. 175, 182 (1981) (citing cases). The Federal Circuit's suggestion requirement bears out the wisdom of this Court's admonition. As illustrated in this case, the suggestion requirement unduly narrows the scope of the obviousness defense, and improperly protects patents based upon minor advances upon knowledge already in the public domain.

1. Respondent Ecolochem, Inc. is a water treatment company. (App., *infra*, 3a, 46a). Patent No. 4,818,411 ("the '411 patent"), which was issued to Ecolochem on April 4, 1989, describes a process for removing dissolved oxygen from water at ambient temperatures. The process consists of: (i) the addition of the chemical hydrazine to water containing dissolved oxygen, followed by passage of the water through an activated carbon column, which catalyzes a reaction between the hydrazine and the oxygen whereby the oxygen is eliminated; and (ii) subsequent passage of the deoxygenated water through cation and anion exchange resins, which then remove any excess hydrazine or ionic contaminants leached from the carbon.[1] (App., *infra*, 4a-5a). All but the final ion exchange step was described in a 1957 publication by F.R. Houghton (referred to herein as the "Houghton process") (App., *infra*, 76a-77a). The Houghton publication also referred to the fact that the carbon catalyst in his process gave off contaminants, but did not offer a way to eliminate them. Court of Appeal Joint Appendix ("CA JA") 1263-67. By the time of the invention, however, the ability of ion exchange resins to remove both

---

[1] Ions are electrically charged atoms or particles Cations are positively charged; anions are negatively charged. (*App.*, infra, 48a, 144a).

hydrazine and carbon contaminants had been taught in several prior art references, and was well-known to those of ordinary skill in the art. (App., *infra*, 77a-78a) (CA JA 775, 790AB-AC, 315, 380A-380D, 447, 551-54, 626-27, 826-827, 895-97, 1238-40).

Petitioner SCE owns and operates a pressurized water reactor ("PWR") for power generation which uses large volumes of high-purity water. (App., *infra*, 3a, 46a-47a). In 1982, a research organization for the nuclear industry issued guidelines calling for PWRs to reduce dissolved oxygen levels in ambient temperature water used to supplement their water supply. (App., *infra*, 3a-4a, 54a-55a). Shortly after these guidelines were issued, SCE asked Ecolochem, which had been supplying SCE's supplemental water, to deoxygenate that water. (App., *infra*, 4a, 55a). Ecolochem soon thereafter developed the process described in the '411 patent, and began supplying SCE with deoxygenated water (App., *infra*, 4a, 57a-60a). In 1986, after building a permanent facility to meet its supplemental water needs, SCE discontinued Ecolochem's services. (App., *infra*, 4a, 60a, 67a).

2. In June, 1982, Ecolochem brought the present action, alleging, *inter alia*, that the deoxygenation process employed in SCE's permanent facility infringed the '411 patent. (App., *infra*, 72a). Following discovery, SCE brought two successive motions for partial summary judgment on the ground that a prior art reference by Demmitt anticipated and/or rendered obvious seven claims of Ecolochem's patents. The district court granted SCE partial summary judgment on these seven claims. (App., *infra*, 144a-181a). Ecolochem then filed an interlocutory appeal with the Federal Circuit. The Federal Circuit affirmed the district court's judgment as to all but one of the claims, claim 20 of the '411 patent. (App., *infra*, 127a-143a). The district court had found claim 20 to be obvious. (App., *infra*, 181a). The Federal Circuit reversed that finding, holding that, although

comparison of the invention with the prior art established a *prima facie* case of obviousness, factual disputes regarding the so-called "secondary considerations," such as long-felt need for the invention, commercial success, and failure of others to make the invention, precluded an award of summary judgment. (App., *infra*, 135a-137a).

Upon remand, trial was held on claim 20 and other claims of the '411 patent. Following the trial, the district court issued a detailed opinion. (App., *infra*, 39a-126a). After reviewing evidence relating to the three primary *Graham* factors of level of skill in the art, scope and content of the prior art, and differences between the prior art and the patented process, the court held that the prior art disclosed all the elements of Ecolochem's invention, and that the "combined teachings" of the prior art would have suggested the desirability of combining them as Ecolochem had. (App., *infra*, 74a-82a, 101a). The court then reviewed Ecolochem's secondary considerations evidence, and concluded that it did not rebut the showing of invalidity based on the primary *Graham* factors. (App., *infra*, 102a-107a).[2] The court also found that, if the patent were not invalid, SCE would be liable for willful infringement. (App., *infra*, 122a).

3. Ecolochem again appealed to the Federal Circuit. The Federal Circuit affirmed the district court's obviousness judgment as to claim 20, the claim that had previously been considered on appeal. After acknowledging that a *prima facie* case of obviousness existed as to claim 20 (App., *infra*, 26a-27a), the court reviewed all of Ecolochem's "secondary consideration" evidence, and affirmed the district court's holding that it did not rebut the *prima facie* showing of invalidity. (App., *infra*, 36a-37a).

---

[2] The court also found that several of the claims in suit were invalid under the anticipation provisions of section 102 of the Patent Act based upon one prior art reference and accompanying presentation. (App., *infra*, 111a-112a).

With regard to all the other claims, however, the court reversed the trial court's obviousness ruling. (App., *infra*, 26a). The court found the "absence of a convincing discussion of the *specific sources* of the motivation to combine the prior art references" to be a "critical omission" in the district court's analysis. (App., *infra*, 23a) (emphasis added). Dismissing the district court's treatment of the suggestion issue as "conclusory statement[s]" and "implicit findings" (App., *infra*, 19a, 20a), the court found "insufficient" the district court's "implicit generalized finding . . . that, when one of ordinary skill in the art was faced with the problem of deoxygenating water for use in a nuclear power plant and the Houghton article, the combination claimed by Ecolochem in the '411 patent would have been obvious." (App., *infra*, 25a).

SCE timely petitioned for rehearing and/or rehearing *en banc*. The Federal Circuit denied the petition and declined the suggestion for rehearing *en banc* on December 13, 2000. (App., *infra*, 182a). This Petition followed.

REASONS FOR GRANTING THE WRIT

The Federal Circuit itself has recognized that uniform application of the law of 'obviousness' is essential to the commercial incentive that is the core of the patent system." *In re Eli Lilly & Co.*, 902 F.2d 943, 947 (Fed. Cir. 1990). The non-statutory suggestion requirement, however, has prevented such uniform application of the law of obviousness.

Petitioner submits that this Court should grant *certiorari* in order to resolve the important question of whether the suggestion requirement is an essential element of an obviousness defense. Petitioner submits that the suggestion requirement, by dictating that no invention can be found obvious unless the prior art essentially prods the person of ordinary skill into making the invention, has improperly shifted the focus of the section 103 determination

away from the abilities of the hypothetical problem solver in the field of the invention, with full knowledge of the prior art, to draw upon such knowledge to achieve the solution described in the patent. Accordingly, Petitioner submits that this Court should clarify that the suggestion requirement is not an essential element of an obviousness defense, and that the three primary *Graham* factors should be assessed with the purpose of determining whether, at the time of the invention, someone of ordinary skill in the art could "readily deduce" the solution described in the patent from the pertinent prior art. This standard, derived from this Court's decision in *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141 (1989), would no longer treat the hypothetical problem solver as merely a passive vessel incapable of solving problems without a clear suggestion from the prior art. Instead, the obviousness inquiry would return to what Congress intended in enacting section 103 – an inquiry into whether a hypothetical problem solver, actively seeking a solution, could deduce the inventor's solution from the prior art of which the law presumes him to be aware.

I. THIS COURT SHOULD GRANT CERTIORARI TO DETERMINE WHETHER THE SUGGESTION REQUIREMENT IS AN ESSENTIAL ELEMENT OF SECTION 103.

Petitioner submits that the suggestion requirement has outlived its usefulness and should no longer be a required element of a section 103 defense. The doctrine, which derives neither from section 103 nor from this Court's *Graham* decision, is a holdover from a time when the threshold for patenting a combination of old prior art elements was far higher than it is today. As explained below, under modern liberalized notions of patentability, the

suggestion requirement unduly protects many patents based on obvious combinations of prior art from invalidation.[3]

The suggestion requirement originated in nineteenth century patent decisions by this Court. *See, e.g., Day v. Fair Haven & W. Ry. Co.*, 132 U.S. 98, 102 (1889) ("we concur with the circuit court that the [improvement described by the patent] would naturally *suggest* itself to any mechanic, and that its use in that way is within the range of common knowledge and experience") (emphasis added); *Expanded Metal Co. v. Bradford*, 214 U.S. 366, 381 (1909) ("To our minds, Golding's method shows that degree of ingenuity and usefulness which raises it above an improvement obvious to a mechanic skilled in the art, and entitles it to the merit of invention. Others working in the same field had not developed it, and the prior art does not *suggest* the combination of operations which is the merit of Golding's invention") (emphasis added).

At the time of these decisions, the "general condition of patentability,"[4] was that set forth in this Court's decision in *Hotchkiss v. Greenwood*, 11 How. 52 U.S. 248 (1851). *Hotchkiss* established a common law invalidity defense

---

[3] It has been noted that "[j]udicial remedies have always been the major safeguard against invalid patents and overextension of valid patent rights." Alan N. Littman, *Restoring the Balance Of Our Patent System*, 37 IDEA: J. L. & Tech. 545, 549 (1997). However, it has become increasingly difficult to invalidate patents since the creation of the Federal Circuit. From 1982 through 1994, the Federal Circuit was four times more likely to reverse a district court's judgment of obviousness than its judgment of nonobviousness. *See* Donald R. Dunner et al., 5 Fed. Circuit B. J. 151, 162, *A Statistical Look at the Federal Circuit's Patent Decisions: 1982-1994* (Summer 1995) (reporting that nearly 90% of district court validity judgments under section 103 were affirmed, as contrasted with only 61% of invalidity judgments); John R. Allison and Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 241 ("the Federal Circuit more commonly reverses trial court findings of invalidity than findings of validity").

[4] *Graham v. John Deere Co.*, 383 U.S. 1, 11 (1966).

which turned on whether a patented device or process was merely "the work of the skilful mechanic," or rather the result of "that degree of skill and ingenuity which constitute essential elements of every invention." *Hotchkiss*, 11 How. (52 U.S.) at 267. Thus, the first inquiries into whether the prior art "suggested" the inventor's work were undertaken as part of this Court's efforts to distinguish between the work of the "skilful mechanic" and instances of true "invention."

In 1952, Congress amended the Patent Act, adding Section 103, which states in relevant part that a "patent may not be obtained . . . if the differences between the subject matter . . . sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. § 103. This amendment supplanted the *Hotchkiss* standard of "invention" with that of "nonobviousness," and added the latter to the pre-existing statutory patentability requirements of utility and novelty. The statutory language did not predicate a showing of obviousness upon evidence of a "suggestion" to combine the prior art in the manner of the invention; it instead focused merely on whether the differences between the invention and the prior art were such that the invention would have been obvious to one of ordinary skill at the time the invention was made.

This Court first construed the language of section 103 thirty-five years ago, in *Graham*. The Court identified the three factual issues relevant to a section 103 defense:

> the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the art resolved.

Id. at 17. "Against this background," the Court stated, "the obviousness or nonobviousness of the subject matter is

determined."[5] *Id.* The court did *not* identify any requirement that there be evidence of a "suggestion" to combine the prior art in the manner of the invention.

Thus, neither section 103 itself nor the *Graham* decision made any reference to a suggestion requirement. *See, e.g.*, Michael J. Pender, *Judicial Review of PTO Patentability: Determinations Under the Substantial Evidence Standard of Review*, 82 J. Pat. & Trademark Off. Soc'y 431 (June 2000) ("[t]he requirement to demonstrate a motivation for combining references is not found in the statutory language of the Patent Act, nor in the analysis of section 103 by the Supreme Court in *Graham v. John Deere*, nor in the Code of Federal Regulations"); Alan P. Klein, *A Funny Thing Happened on the Way to the Non-Obvious Subject Matter Condition for Patentability on Its Way to the Federal Circuit*, 6 U. Balt. Intell. Prop. L. J. 19, 20 (Fall 1997) ("The 'suggestion' requirement does not appear in 35 U.S.C. § 103, nor was it mentioned in *Graham*. . . .").

The Court of Custom and Patent Appeals ("CCPA"), however, which had employed the suggestion standard as part of the *Hotchkiss* test of patentability,[6] continued to apply

---

[5] The Court also noted that "secondary considerations," such as commercial success of the invention, long felt but unresolved needs to attain the goal of the invention, and failure of others to reach the inventor's solution, "may have relevancy" as "indicia of obviousness or nonobviousness." 383 U.S. at 18. As mentioned above, although secondary considerations evidence was the focus of the trial in the district court, it is not at issue on the present petition, because the Federal Circuit acknowledged that such evidence was not sufficient to overcome a *prima facie* case of obviousness.

[6] *See, e.g., In re Fridolph*, 134 F.2d 414, 416 (C.C.P.A. 1943) ("the question . . . is: does such art *suggest* doing the thing which the appellant has done?") (emphasis added); *accord In re Dalzell*, 152 F.2d 1013, 1014 (C.C.P.A. 1946) ("in considering more than one reference to the prior art, the question always is whether such art *suggests* doing the thing which the applicant has done") (emphasis added); *In re Shaffer*, 229 F.2d 476, 479 (C.C.P.A. 1956)("to determine whether the combination of references is proper, the following criterion is often used: namely,

that standard even after the passage of section 103 and this Court's *Graham* decision. In several cases, the CCPA articulated a very strict view of the suggestion standard as requiring that the references containing the elements of the invention must themselves suggest the advisability of combining them.[7]

The CCPA's expansion of this Court's suggestion standard into a strict evidentiary requirement for establishing obviousness occurred against the backdrop of another important development in the law of obviousness – this Court's increasing skepticism, beginning shortly before the 1952 amendments to the Patent Act, that mundane combinations of old prior art elements could merit patent protection. *See, e.g., Great A. & P. Tea Co. v. Supermarket Corp.*, 340 U.S. 147, 155, 153 (1950) ("Courts should scrutinize combination patent claims with a care proportioned to the difficulty and improbability of finding invention in an assembly of old elements. . . . A patent for a combination which only unites old elements with no changes in their respective functions . . . obviously withdraws what

---

whether the prior art *suggests* doing what an applicant has done. . . . Furthermore, when references are combined to negate patentability, it should also be considered whether one skilled in the art with the references before him could have made the combination of elements claimed without the exercise of invention") (emphasis added).

[7] *See, e.g., In re Hortman*, 264 F.2d 911, 914 (C.C.P.A. 1959) ("It is well settled that [two] references may not be combined where 'there is no suggestion in either of the references that they can be combined . . . to meet the recitation of appellant's claims.'"); *In re Avery*, 518 F.2d 1228, 1234 (C.C.P.A. 1975) (reversing obviousness finding where "[n]either reference contains the slightest suggestion to use what it discloses in combination with what is disclosed in the other"); *In re Rinehart*, 531 F.2d 1048, 1054 (C.C.P.A. 1976) (the "[a]bsence of any suggestion in either [of the two pertinent references] that features of the process of one should be combined with features of the other to achieve the commercial scale production of which neither is capable requires a holding that the rejection herein was improper.").

already is known into the field of its monopoly and diminishes the resources available to skillful men. . . .").

Even after passage of the 1952 Patent Act, this Court continued to take the view that inventions based on combinations of old prior art elements were not patentable unless the combination exhibited synergistic effects or achieved unexpected results. *See Anderson's-Black Rock v. Pavement Co.*, 396 U.S. 57, 61 (1969) (after noting that a "combination of elements may result in an effect greater than the sum of the several effects taken separately," Court held patent invalid where "[n]o such synergistic result is argued"); *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 282 (1976) ("this patent simply arranges old elements with each performing the same function it had been known to perform, although perhaps producing a more striking result than in previous combinations. Such combinations are not patentable under standards appropriate for a combination patent.").

Given the high threshold on patentability imposed by the synergy and "effects greater" tests, the CCPA's evidentiary suggestion requirement served a useful purpose in the early years of section 103. Absent some "suggestion" in the prior art to combine certain teachings in the manner of the invention, an invention that achieved synergistic effects or "unexpected results" could hardly be considered to have been obvious to a person of ordinary skill at the time of the invention; if it would have been obvious that such results could be obtained, they would not have been "unexpected." Accordingly, requiring a party asserting obviousness to introduce evidence, existing at the time of the invention, of a suggestion to combine the prior art in the manner of the invention served as a valuable check on the improper invalidation of a patent on the basis of hindsight.

When the Federal Circuit was formed in 1982, it adopted the case law of the CCPA as binding precedent. *South Corp. v. United States*, 690 F.2d 1368 (Fed. Cir. 1982).

In an early decision, *In re Sernaker*, 702 F.2d 989 (Fed. Cir. 1983), the Federal Circuit examined CCPA decisions in an attempt to find a rational distinction between those cases where the CCPA had found there to be the requisite suggestion to combine references and those where it had not. The court's review reflected that the suggestion requirement, as applied by the CCPA, had been tied to the synergy and "unexpected results" requirements for patents based on combinations of old prior art elements.

The court contrasted two cases, *In re Scheckler*, 438 F.2d 999 (C.C.P.A. 1971), and *In re Imperato*, 486 F.2d 585 (C.C.P.A. 1973). In *Scheckler*, the CCPA had found a patent for a building block for wall construction obvious based on two prior art references which together contained all the elements of the invention. Acknowledging the straightforward nature of the invention, the Federal Circuit observed that "[i]t could not have placed any great strain on the intellect of the [CCPA] to sustain the board's conclusion of obviousness." *Sernaker*, 702 F.2d at 995. The court then articulated a relaxed view of the suggestion requirement which indicated that, where the patent accomplished no more than one would expect from combining the pertinent prior art teachings, it would not present an evidentiary impediment to an obviousness determination.

> [i]t was not necessary that the prior "art suggest expressly or in so many words, the changes or possible improvements" the inventor made. It was only necessary that he apply "*the knowledge clearly present in the prior art*."

Id. (quoting *Sheckler*) (emphasis in original). The court then considered *Imperato*. The invention in *Imperato*, which described a method of preparing ore for use as fuel in a blast furnace, was also little more than a combination of the teachings of two prior art references. However, the

combination in *Imperato* had resulted in an improvement in the strength of the ore at high temperatures, a result that would not have been expected from review of the prior art teachings. Accordingly, the CCPA had upheld that validity of the patent. Contrasting the different outcomes in *Scheckler* and *Imperato*, the Federal Circuit drew the following conclusion: "[t]he lesson . . . appears to be that prior art references in combination do not make an invention obvious unless something in the prior art references would suggest the advantage to be derived from combining their teachings." 702 F.2d at 995-96.

Based upon these cases and other CCPA precedent, the *Sernaker* court articulated a formulation of the obviousness inquiry as asking "whether the claimed invention *achieved more* than a combination which any or all of the prior art references suggested, expressly or by reasonable implication." *Id.* at 994 (emphasis added). The *Sernaker* test, then, consistent with the synergy requirement for combination patents, focused on whether the inventor's contribution to the art was greater than would have been suggested by the mere combination of the pertinent prior art teachings.

Shortly after the *Sernaker* decision, however, the Federal Circuit did away with the synergy and "effects greater" tests. The court held that these tests improperly added a restriction on patentability not contained in the Patent Act:

> In determining patentability, we are guided, as we must be guided, by the statute. A requirement that an invention reflect "synergism" or achieve a "synergistic result," before it may be held patentable appears nowhere in the statute, 35 U.S.C. The test of obviousness under 35 U.S.C. § 103, as the statute makes plain, is whether the invention

> as a whole would have been obvious at the time it was made to one of ordinary skill in the art. References to synergism as a patentability requirement are, therefore, unnecessary and confusing.

Chore-Time Equipment, Inc. v. Cumberland Corp., 713 F.2d 774, 781 (Fed. Cir. 1983); *Kansas Jack, Inc. v. Kuhn*, 719 F.2d 1144, 1150 (Fed. Cir. 1983)("No requirement for 'an effect greater' or for 'unusual or surprising results' is present in the statute, 35 U.S.C. § 103."). Thus, after *Chore-Time* and *Kansas Jack*, combinations of old prior art elements that achieved *predictable* results were patentable so long as the combination itself was not obvious.

While jettisoning the "unexpected results" and "synergetic effects" tests, however, the court retained the suggestion requirement that had been applied within the context of those tests. Petitioner submits that in so doing, the Federal Circuit imposed an unnecessary burden on parties challenging the validity of a patent.

As noted above, combinations of prior art that achieve synergetic effects or "unexpected results" are unlikely to occur to persons ordinarily skilled in the art absent some suggestion in the art. Inventions consisting of minor and predictable modifications to the prior art, on the other hand, may well have been obvious at the time of the invention to the hypothetical problem solver trying to solve the problem faced by the inventor, irrespective of whether a specific teaching suggested making the "inventive" combination.[8]

---

[8] In this regard, it must be borne in mind that the hypothetical artisan against whom obviousness is measured is presumed to have perfect knowledge of all publicly-available information in the relevant art. *See Mast, Foos & Co. v. Stover Mfg Co.*, 177 U.S. 485, 493 (1900) (the hypothetical "[skillful] mechanic" is "chargeable with knowledge of all preexisting devices").

There are many reasons why, even for obvious improvements to the prior art, evidence of a specific suggestion to make the "inventive" combination is often hard to come by: authors in the art do not write about all the myriad modifications to the prior art that they know are feasible; the most pertinent prior art may be obscure and thus infrequently discussed; or the problem which the inventor solved may have arisen only shortly before his invention, and thus may not have been addressed in the relevant literature prior to the time of the invention. Demanding strict adherence to a requirement that a patent challenger must prove a specific suggestion to combine the prior art in the manner of the invention thus can present an evidentiary hurdle that improperly rescues weak patents from invalidation.

Indeed, nearly sixty years ago, the CCPA warned that overly rigorous application of the suggestion requirement would narrow the obviousness defense to the point where it would become merely cumulative of the section 102 defense of anticipation:

> If appellant's contention [that the cited art must teach how to combine the cited structures] should be sustained then it would never be necessary to combine references to negative patentability, for if one of the references mu[st] teach the combination claimed, that reference would be a complete anticipation of the invention and there would be no occasion to combine references.

In re Milne, 140 F.2d 1003, 1005 (C.C.P.A. 1944); Robert Desmond, *Nothing Seems "Obvious" to the Court of Appeals for the Federal Circuit: The Federal Circuit, Unchecked by the Supreme Court, Transforms the Standard of Obviousness Under the Patent Law*, 26 Loy. L.A. L. Rev. 455, 475-476 (1993) ("prior art rarely suggests a 'new' combination

because an inventor would most likely have patented any 'new' combination. Therefore, through its suggestion test, the CAFC effectively ensure[s that] it [will] rarely find patents for new combinations of prior art obvious.").

The Federal Circuit's own struggles in applying the suggestion requirement reflect the inherent tension between the harshness of the rule and modern liberalized notions of patentability. Some Federal Circuit decisions, adopting the restrictive view first articulated in the decisions of the CCPA, indicate that the clear and convincing evidence of a suggestion to combine must be found somewhere in the references whose combined teachings disclose the elements of the invention.[9] Others, chafing at the evidentiary rigors of the rule when faced with minor improvements to the prior art, have adopted formulations that are so generous as to be virtually toothless, finding that the suggestion to make the inventive combination can be "implicit" in the art, can reside in the prior art "as a whole," can lodge in the general "knowledge" of those ordinarily skilled in the art, or can arise from the "nature of the problem" that the inventor was trying to solve.[10] Often the Federal Circuit's conflicting views find expression in the same opinion.[11]

---

[9] *See, e.g., In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir.1992) ("Neither [of the two cited references] alone or in combination, provide any incentive to combine the teachings of the prior art in the manner maintained by the Board"); *In re Gorman*, 933 F.2d 982, 986 (Fed. Cir. 1991) ("The *references themselves* must provide some teaching whereby the applicant's combination would have been obvious.") (emphasis added); *Panduit Corp. v. Dennison Mfg.*, 810 F.2d 1561, 1586 (Fed. Cir. 1987) ("elements of separate prior [art] patents cannot be combined when there is no suggestion of such combination anywhere *in those patents*. . . .") (emphasis added); *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1462 (Fed.Cir.1984) (reversing obviousness ruling on grounds that "[n]othing in the references alone or together suggests the claimed invention.")

[10] *See, e.g., In re GPAC, Inc.*, 57 F.3d 1573, 1581 (Fed. Cir. 1995) (finding patent claims obvious where their subject matter was "implicitly

suggested to one of ordinary skill" by the prior art); *Cable Electric Products, Inc. v. Genmark, Inc.*, 770 F.2d 1015 (Fed. Cir. 1985) ("suggestion to modify the art to produce the claimed invention need not be expressly stated in one or all of the references used to show obviousness"; where "straight-forward quality of the invention and art involved make the required combination quite apparent," necessary suggestion properly found in the "knowledge clearly present in the prior art") (internal quotation marks omitted); *In re Beattie*, 974 F.2d 1309, 1312 (Fed. Cir. 1992) (suggestion to combine need only be "provided by the prior art taken as a whole"); *Motorola Inc. v. Interdigital Technology Corp.*, 121 F.3d 1461, 1472 (Fed. Cir. 1997) ("the suggestion to combine may come from the prior art, as filtered through the knowledge of one skilled in the art"); *In re Micro Chemical, Inc. v. Great Plains Chemical Co., Inc.*, 103 F.3d 1538 (Fed. Cir. 1997) (suggestion to combine references may "come from the nature of a problem to be solved, leading inventors to look to references relating to possible solutions to that problem.") (citations and internal quotations omitted).

[11] *See, e.g., Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 n.24 (Fed. Cir. 1985) ("To properly combine references A and B . . ., case law requires that there must have been some teaching, suggestion, or inference in either reference A or B, or both, or knowledge generally available to one of ordinary skill in the relevant art, which would have led one skilled in the art to combine the relevant teachings of references A and B."); *id.* at 297 (nonetheless holding district court's conclusion of obviousness to be in error where court "did not elucidate any factual teachings, suggestions or incentives" from the cited prior art references that "showed the propriety of combination") (emphasis added); *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988) (stating test as only requiring "some objective teaching in the prior art or . . .knowledge generally available to one of ordinary skill in the art [that] would lead that individual to combine the relevant teachings of the references"); *id.* at 1075 (nonetheless holding that "[b]ecause neither Warnick nor Eads, alone or in combination, suggests the claimed invention, the Board erred in affirming the Examiner's conclusion that it would have been obvious to substitute the Warnick nitric oxide detector for the Eads sulfur dioxide detector in the Eads system"); *WMS Gaming, Inc. v. International Game Technology*, 184 F.3d 1339, 1355 (Fed. Cir. 1999)(stating rule that "suggestion to combine may be found in explicit or implicit teachings within the references themselves, from the ordinary knowledge of those skilled in the art, or from the nature of the problem to be solved"); *id.* at 1359 (nonetheless reversing obviousness finding because "WMS fails to point to anything *in Nonaka or Cohen* [the cited prior art references] that

The Federal Circuit's vacillation on the suggestion requirement has not gone unremarked, either by members of the Court itself or commentators. The late Judge Nies made reference to it in her concurrence in *In re Oetiker*, 977 F.2d 1443 (Fed. Cir. 1992):

> [T]here must be some teaching, reason, suggestion, or motivation found 'in the prior art' or 'in the prior art references' to make a combination to render an invention obvious within the meaning of 35 U.S.C. § 103 (1988). Similar language appear in a number of opinions and if taken literally would mean that an invention cannot be held to have been obvious unless something specific in a prior art reference would lead an inventor to combine the teachings therein with another piece of prior art. *This restrictive understanding of the concept of obviousness is clearly wrong* . . . . While there must be some teaching, reason, suggestion, or motivation to combine existing elements to produce the claimed device, it is not necessary that the cited references or prior art specifically suggest making the combination. Such suggestion or motivation to combine prior art teachings can derive solely from the *existence* of a teaching, which one of ordinary skill in the art would be presumed to know, and the use of that teaching to solve the same or similar problem which it addresses.

Id. at 1448 (Nies, J., concurring) (footnote omitted and internal citations; emphasis added). Notwithstanding Judge Nies' admonition, the strict articulation of the suggestion

---

indicates a motivation to combine the teachings of those references with Saxton") (emphasis added).

requirement has continued to appear in the Federal Circuit's obviousness decisions. *See, e.g., In re Brouwer*, 77 F.3d 422, 425 (Fed. Cir. 1996) (reversing obviousness determination where "there is simply no suggestion in the [cited] references" that they could be combined in the manner of the invention); *C. R. Bard*, 157 F.3d at 1351 (holding that suggestion "must come from the prior art," and reversing invalidity judgment where "[n]o prior art provided a teaching or suggestion" to combine art in manner of invention).

The uncertain evidentiary demands of the suggestion requirement have dramatically affected patent litigation. As one commentator observed in 1993:

> The exact boundaries of the obviousness standard are far from clear, leaving inventors, investors, patent agents and attorneys alike troubled with the unsteady ground which a patent may tread upon either when initially examined by the U.S. Patent Office . . . or in subsequent litigation after issuance of the patent. One of these boundaries of the obviousness standard which has been typically difficult to quantify, has been the area of combining references. Specifically, the issue of what is required under current patent law to simply make the combination of references appropriate is uncertain.

Irah H. Donner, *In re Beattie: Is The Obviousness Standard No Longer Obvious?*, 10 No. 4. Computer Law. 18 (April 1993). Seven years later, this criticism was still valid:

> There appears to be substantial disagreement regarding what constitutes an acceptable rationale for combining references. In theory, the Federal Circuit recognizes three possible sources of motivation, the nature of the problem to be solved, the teachings of the

> prior art, and the knowledge of persons of ordinary skill in the art. In practice, the argument that the motivation to combine references is found in the 'nature of the problem to be solved' has a poor success rate at the Federal Circuit. The Federal Circuit also considers the argument that [the] problem to be solved is well within the proficiency of one having ordinary skill in the art [as] insufficient to establish a motivation to combine references.

See Pender, *supra*, 82 J. Pat & Trademark Off. Sec'y at 450; *see also* Kathleen N. McKereghan, *The Nonobviousness of Inventions: In Search of a Functional Standard*, 66 Wash. L. Rev. 1061 (1991) ("nonobviousness is a requirement in need of an improved standard").

Petitioner submits that the Court should grant *certiorari* and eliminate the confusing and inconsistently applied suggestion requirement as an essential element of proof in a section 103 obviousness defense. Petitioner submits that the Court should clarify that the three factors identified in *Graham* are to be evaluated with the following inquiry in mind: whether the person of ordinary skill in the art would have been able to "readily deduce" the invention had he been aware of all of the pertinent prior art. This standard derives from this Court's decision in *Bonito Boats,* in which the court described the nonobviousness requirement of the Patent Act as extending the "field of unpatentable material beyond that which is known to the public under § 102, to include that which could *readily be deduced* from publicly available material by a person of ordinary skill in the pertinent field of endeavor." 489 U.S. at 150 (emphasis added).

As one commentator has noted, this notion of patentability as requiring that an invention not be "readily

deducible" from the prior art more faithfully reflects the rationale underlying the obviousness defense than the suggestion requirement employed by the Federal Circuit:

> The [Supreme Court's standard of deducibility] describe[s] an *active role* for the hypothetical person of skill assessing the prior art. [It] assess[es] nonobviousness from the perspective of the perceiver. The analysis focuses on the intellectual reaction of the person of ordinary skill. Prior art is relevant to the inquiry, but is not endowed with activating, stimulating abilities. The active role of the hypothetical person mimics the actual inventive process.
>
> A major flaw in the lower court standards is that suggestion, desirability and motivation incorrectly imply that knowledge and inventive stimuli exist inherently in the prior art. Invention apparently occurs when the inventor is *acted upon* by the inherent knowledge or stimuli contained in the prior art. The standards focus on the prior art content that is the basis for the inventive conclusion, rather than the action of deduction.

McKereghan, 66 Wash. L. Rev. at 1072 (emphasis added). Thus, whereas the Federal Circuit's articulation of the suggestion test treats the hypothetical person of ordinary skill as a passive vessel, incapable of action unless stimulated by the prior art, the "readily deducible" standard would adhere to the principle that obviousness must be measured from the perspective of someone actively trying to solve the same problem facing the inventor. *See* Donald Chisum, *Chisum on Patents*, § 504[1][c] (2000) ("[T]he test [of obviousness] assumes that the problem to which the invention is addressed

was presented to the hypothetical mechanic for solution. This is a fundamental point frequently overlooked."); *Pro-Mold & Tool Co., Inc. v. Great Lakes Plastics, Inc.*, 75 F.3d at 1568, 1573 (Fed. Cir. 1996) ("[w]e start from the self-evident proposition that mankind, in particular, inventors, strive to improve that which already exists"). By focusing on the ability of someone of ordinary skill to come up with the invention, rather than upon the stimulating properties of the prior art, the test would also take into proper account the level of skill of persons ordinarily skilled in the art. Presently, this element of the *Graham* inquiry is virtually ignored as the Federal Circuit focuses on the content of the art itself, rather than on the capabilities of a skilled artisan in the art.

Under Petitioner's proposed reformulation of the section 103 inquiry, evidence of a suggestion in the art to combine the prior art teachings in the manner of the invention would still be relevant to show that the invention would have been "readily deducible" from the prior art; it would simply not be an essential part of the challenger's proof. Thus, situations like the present case – where the patent describes a simple modification to the prior art, and where the secondary consideration evidence does not demonstrate patentability – would not lead to a patent being upheld solely because of a failure of proof on a non-statutory evidentiary requirement. Adequate protection against the risk of hindsight reconstruction (the Federal Circuit's stated rationale for the suggestion requirement) would still exist in the form of the real-world evidence of secondary considerations identified in *Graham*, including long-felt need, commercial success, and failure of others to achieve the invention.

II. THIS CASE IS WELL-SUITED FOR CERTIORARI, BECAUSE ELIMINATION OF THE SUGGESTION ELEMENT HERE REQUIRES REVERSAL OF THE FEDERAL CIRCUIT'S JUDGMENT.

This case is a perfect illustration of how the Federal Circuit's suggestion requirement – an artifact from the days when the patentability of prior art combinations depended upon their achieving synergetic effects or unexpected results – has placed an improper evidentiary burden upon defendants asserting a section 103 defense. As shown below, replacement of the suggestion requirement with Petitioner's proposed "readily deducible" standard would require reversal of the Federal Circuit's judgment.

In this case, the patentee's invention involved a simple modification to a prior art reference of which anyone skilled in the pertinent art – the art of water purification – would have been aware. Specifically, the Houghton reference taught the addition of hydrazine to water containing dissolved oxygen, and the passage of that water over an activated carbon bed in order to catalyze a reaction between the hydrazine and the oxygen which removed the oxygen. Ecolochem merely modified Houghton by adding a clean-up step of passing the deoxygenated water through an ion exchange resin to remove any unreacted hydrazine or ionic contaminants given off by the carbon bed.

By the time of Ecolochem's invention, some thirty years after Houghton wrote his article, the clean-up step had become commonplace. As one 1981 reference, a patent by Hegde, stated:

> Activated carbons contain ionic impurities, and occasionally collect microorganisms, which are released into the water. *They are therefore normally used prior to treatment of*

> *the water with mixed ion exchange resins which remove the ions released.*

CA JA 1693.[12] In addition, SCE's expert testified that, by the time of Ecolochem's invention, it was common practice to follow carbon beds with ion exchange to "clean up" any contaminants given off by the carbon bed. CA JA 315, 380A-380D, 447. Other witnesses corroborated that, prior to Ecolochem's invention, it was known both that carbon beds leached ionic contaminants, and that such contaminants were removable by ion exchange. CA JA 551-554, 626-27, 826-27, 895-97. An Ecolochem technician testified that carbon was never used as the last step in a water treatment array, because it was known to give off "leachables" that were not acceptable for high-purity water, CA JA 1238-1240, and Ecolochem's own expert testified that it was obvious at the time of the invention both that carbon beds gave off contaminants, and that the most popular choice to remove such contaminants was ion exchange. CA JA 775, 790AB-790AC.[13] In addition, the level of skill in the art of water purification was high (App., *infra*, 76a), suggesting that

---

[12] Ecolochem conceded at trial that the notion of using a cation exchange resin to remove excess hydrazine was obvious at the time of the invention. CA JA 721. Thus, the obviousness inquiry before the district court and on appeal focused on whether the removal of the carbon contaminants by mixed bed ion exchange was also obvious.

[13] The Federal Circuit down played the foregoing evidence, focusing instead on testimony by the inventors that they *personally* did not know prior to their invention that carbon beds gave off contaminants that could be removed by ion exchange. (App., *infra*, 17a). In so doing, the court lost sight of the fact that, as this Court noted in *Graham*, it is irrelevant whether the actual inventor lacked the knowledge of the prior art which the hypothetical person of ordinary skill is legally presumed to have. *See Graham*, 383 U.S. at 36 (finding it "irrelevant . . . that no one apparently chose to avail himself of knowledge stored in the Patent Office and readily available by the simple expedient of conducting a patent search"); *In re Gorman*, 933 F.2d 982, 986 (Fed. Cir. 1991)("When the references are all in the same or analogous fields, knowledge thereof by the hypothetical person of ordinary skill is presumed").

persons ordinarily skilled in the art, had they had knowledge of all the pertinent prior art, would have been able to apply that knowledge to modify the Houghton process by adding an ion exchange clean-up step.

SCE even introduced the most compelling possible real-world evidence that someone of ordinary skill in the art could have "readily deduced" the invention from the prior art, namely, evidence that someone of ordinary skill in the art had *actually made* Ecolochem's invention shortly prior to the issuance of Ecolochem's patent. (App., *infra*, 33a-34a, 90-91a, 105a). *See In re Farrenkopf*, 713 F.2d 714, 720 (Fed. Cir. 1983) (near-simultaneous invention shows that someone was "*motivated by the prior art teachings* to invent a method corresponding to the claimed invention") (emphasis added).

Indeed, SCE even produced evidence going *directly* to the ultimate obviousness inquiry: both sides' experts testified that, had someone of ordinary skill at the time of the invention facing the problem identified by Ecolochem – the need for an improved ambient temperature deoxygenation process for high purity applications – been given the obscure Houghton reference[14] and asked to adapt it to high-purity use, *she would successfully have made Ecolochem's invention.* (App., *infra*, 95a).

The Federal Circuit brushed this evidence aside as improperly "presum[ing] the very problem at hand," by presuming that the person of ordinary skill would have considered improving Houghton. (App., *infra*, 26a). The court stated that, while "[w]ith hindsight" Houghton might "seem like an obvious place to start to address the need in the power plant industry" for an improved deoxygenation process, Houghton had "incumbent disadvantages," including "the release of unwanted impurities." (App., *infra*, 24a). Based on these purported disadvantages, the court held, if

---

[14] At trial, Ecolochem itself described Houghton at trial as a "long-forgotten process." CA JA 309A; *see also* App., *infra*, 77a.

someone of ordinary skill in the art had been given Houghton at the time of the invention, "they would not have been inclined to use it." (App., *infra*, 26a).

The court's reasoning, however, lost sight of the fact that, in the obviousness inquiry, the hypothetical person of ordinary skill must be assumed to consider all prior art within the field of the invention. *See, e.g., Stratoflex v. Aeroquip Corp.*, 713 F.2d 1530, 1535 (Fed. Cir. 1983) (obviousness inquiry assumes hypothetical person of ordinary skill would consider all art "reasonably pertinent to the particular problem with which the inventor was involved," including all art that such a person would include "in his search for a solution to [the] problem" facing the inventor); *Pentec v. Graphic Controls Corp.*, 776 F.2d 309, 314 (Fed. Cir. 1985) (prior art must be considered as part of obvious inquiry where it is "within the scope of the prior art to which one having ordinary skill in the art would have looked").

Thus, the law *presumes* that someone of ordinary skill in the art would have considered Houghton, a reference in the same field –water treatment – as that of the invention. (App., *infra*, 99a). While the Federal Circuit held that a person of ordinary skill in that art would have been discouraged from using Houghton because of other prior art discussing the fact that Houghton's process gave off carbon contaminants, virtually all of the references cited by the court were from the 1950's and 1960's. (App., *infra*, 21a-22a). As the 1981 Hegde reference reflects, by the time of Ecolochem's invention, the solution to the leaching of contaminants by carbon beds was well-known to those of ordinary skill in art – adding ion exchange beds downstream of the carbon bed. Thus, as both sides' experts agreed, *by the time of the invention*, if someone of ordinary skill had considered Houghton as a possible solution to the need for a better

ambient temperature deoxygenation process, he or she would have achieved Ecolochem's invention.[15]

There can be no clearer evidence of how the suggestion requirement has imposed a wholly unjustified evidentiary impediment to an obviousness determination than in the Federal Circuit's disregard of the experts' direct testimony of the obviousness of Ecolochem's patent. (App. *infra*, 25a) (finding "insufficient" district court's finding "that, when one of ordinary skill in the art was faced with the problem of deoxygenating water for use in a modern power plant and the Houghton article, the combination claimed by Ecolochem in the '411 patent would have been obvious").

The error in the Federal Circuit's analysis becomes further apparent when its decision is contrasted with that of this Court in *Calmar, Inc. v. Cook Chemical Co.*, the companion case decided with *Graham*. *Calmar* involved an invention consisting of a plastic finger sprayer with a "hold-down" lid used for dispensing liquid products such as household insecticides. The prior art included a patent, Lohse, for a sprayer which employed a different mechanism for sealing the plastic overcap that screwed over the top of and depressed the sprayer. An additional prior art reference, Livingstone, disclosed the sealing feature. 383 U.S at 31.

---

[15] The court cited the district court's opinion for the proposition that mixed bed ion exchange as a method of removing carbon contaminants "had detractors." (App., *infra*, 23a). In support of this claim, however, the court cited a finding which simply reflected SCE's opinion that a water purification system containing two sets of cation and anion beds in series was preferable to a system containing cation, anion, and mixed bed. A mixed bed is simply a vessel in which cation and anion exchange resins are combined in a single bed, rather than in separate beds. (App., *infra*, 48a). The claims of the '411 patent do not require use of a mixed bed rather than cation and anion beds in series; either method is within the scope of the claims. (App., *infra*, 41a-42a). Accordingly, a preference for separate cation and anion beds over a mixed bed does not "detract" from the general ion exchange solution described in the patent.

This Court found the combination of elements obvious, without any discussion of whether there was a suggestion in the references to combine them, or to use the Lohse patent as a starting point. The analysis was simple and straightforward; because both references were within the relevant field of art, they were properly considered for purposes of assessing obviousness. Upon comparison of the invention to the combined teachings of the references, the Court noted that the invention "rest[ed] upon exceedingly small and quite non-technical mechanical differences in a device which was old in the art." *Id.* at 36. Accordingly, the Court affirmed the lower court's finding of invalidity.

This case is nearly identical. Ecolochem's invention is a simple adaptation of the little-known Houghton process for applications in which its carbon contaminants needed to be removed. The trial evidence showed that the need for such an ambient temperature process arose almost immediately before Ecolochem developed its invention, when the issuance of stricter dissolved oxygen specifications prompted nuclear plants to increase their deoxygenation efforts. (App., *infra*, 29a, 54a-55a). Within a year of this need arising, Ecolochem fortuitously learned of the obscure Houghton reference, and quickly made the single modification needed to adapt it to high-purity use. (App., *infra*, 29a, 103a). Ecolochem's simple modification to neglected prior art, though timely, simply did not deserve the legal monopoly afforded by the patent laws. *See Sakraida*, 425 U.S. at 282 (appellate court erred in reversing invalidity judgment where patent merely constituted work of skillful mechanic, notwithstanding that invention was "doubtless a matter of great convenience, produc[ed] a desired result in a cheaper and faster way, and enjoy[ed] commercial success").

By focusing unduly on whether there was some specific suggestion in the prior art to combine the relevant references, the Federal Circuit lost sight of the true nature of the obviousness inquiry – whether someone ordinarily skilled

in the art, facing the same problem facing the inventor, could have arrived at the same solution if he had knowledge of all the pertinent prior art. Despite having direct evidence on this question from both sides' experts, the court reversed the judgment in SCE's favor because the prior art did not contain an express suggestion to make Ecolochem's modification.

Under the standard applied by the Federal Circuit here, any minor modification to obscure prior art – however obvious – will merit patent protection. Long-forgotten or obscure references, like the primary Houghton reference, are rarely discussed in the literature. Accordingly, there is very little likelihood that someone challenging a minor improvement or modification of such an obscure reference will be able to point to "specific sources of motivation" (App., *infra*, 23a) to combine or modify the prior art in the manner of the invention. Patentability thus will become a reward not for inventive activity, but for thorough research, and legal monopolies will be granted for unearthing long-neglected art, rather than for advancing human knowledge beyond that already dedicated to the public. SCE respectfully submits that such was never the intent of the Founders in drafting the Patent Clause to the Constitution nor of Congress in enacting the Patent Act of 1952.

CONCLUSION

The Petition should be granted.

Respectfully submitted,

GREGORY P. STONE
TED G. DANE
Counsel of Record
JONATHAN R. LEVEY
Munger, Tolles & Olson LLP
355 South Grand Avenue, Suite 3500
Los Angeles, California 90071-1560
Counsel for Petitioner Southern California Edison Company

Appendix A

APPENDIX A

No. 99-1043

UNITED STATES COURT OF APPEALS,
Federal Circuit

ECOLOCHEM, INC.,
Plaintiff-Appellant,

v.

SOUTHERN CALIFORNIA EDISON COMPANY,
Defendant-Appellee.

September 7, 2000

Rehearing Denied; Suggestion for Rehearing En Banc Declined Dec. 13, 2000.

Before MICHEL, CLEVENGER, and RADER, Circuit Judges.

MICHEL, Circuit Judge.

Ecolochem, Inc. ("Ecolochem") filed suit in 1992, alleging that Southern California Edison Company ("Edison") infringed Ecolochem's U.S. Patent Nos. 4,556,492 ("the '492 patent") and 4,818,411 ("the '411 patent") when deoxygenating water in the High-Flow Makeup Demineralizer ("HFMUD") at Edison's San Onofre Nuclear Generating Station ("SONGS"). Edison denied infringement, counterclaimed for declaratory judgment of invalidity, and asserted equitable defenses. By grant of partial summary judgment to Edison, the United States District Court for the Central District of California invalidated claims 1, 2, and 5-10 of the '492 patent and claims 20-21 of the '411 patent, holding the subject matter of each of these claims to be either anticipated under 35 U.S.C. § 102 and/or obvious under 35 U.S.C. § 103. On appeal to this court, we reversed the holding by the district court that there was no genuine

issue of material that the invention of claim 20 of the '411 patent would have been obvious at the time of the invention, and remanded the case for a trial on invalidity in light of Ecolochem's evidence of secondary considerations. As to the invalidation of the other appealed claims, we affirmed. Ecolochem continued to assert infringement of claims 1, 3-13, 15, 17, 18, and 20 of the '411 patent after remand, but dropped its suit as to the remaining claims of the '492 patent. After a bench trial, the district court found that Edison had willfully infringed claims 1, 3-13, 15, 17, 18, and 20 of Ecolochem's '411 patent and rejected Edison's equitable defenses. The court then went on to invalidate all of the claims found to be infringed. Ecolochem appeals the holdings of invalidity as to claims 1, 3-13, 15, 17, 18, and 20 of the '411 patent here. Edison does not cross-appeal the district court's finding that Edison willfully infringed those claims of the '411 patent.

We affirm the district court's finding that claim 20 of the '411 patent was proven invalid by clear and convincing evidence both as anticipated under 35 U.S.C. section 102 and obvious under 35 U.S.C. § 103. We reverse its findings of invalidity for anticipation for claims 1, 4, and 7-12 because we discern clear error in the district court's finding that the prior art was proven by clear and convincing evidence to have recited every limitation of claims 1, 4, and 7-12. We also reverse the district court's conclusions that the subject matter of claims 1, 3-13, 15, 17, and 18 of the '411 patent was proven invalid for obviousness by clear and convincing evidence, as we discern clear error in the district court's implicit finding that there was motivation to combine the teachings of the prior art references. As the district

court's findings of willful infringement stand unchallenged, we remand for a determination of damage.

BACKGROUND

Edison operates SONGS, a type of nuclear power plant known as a Pressurized Water Reactor ("PWR"). PWRs use water in two systems, called the "primary system" and the "secondary system." A minute amount of water from the secondary system is lost during each operation cycle. This water must be replaced, and the replacement water is commonly referred to as "make-up water." Because water in the secondary system must be of extremely high purity, make-up water is supplied from a make-up demineralization system, which takes outside source water and refines it through "demineralization," i.e., the removal of mineral ions.

During the start-up operations for SONGS, Edison decided to construct a HFMUD to meet the make-up water needs of SONGS' two active reactors. While the HFMUD was being constructed, Edison employed outside vendors, including Ecolochem, to provide the needed make-up water. Before hiring Ecolochem, Edison hired other vendors who provided poor quality water and constantly shuttled demineralization trucks on and off Edison's property to meet Edison's requirements. In the summer of 1982, Edison hired Ecolochem to provide purer quality water at the large volumes Edison needed to meet its make-up water needs. Ecolochem used a patented "Mobile Flow" trailer apparatus to provide water treatment services, which enabled it to regenerate its trailers on-site, thus avoiding the other vendors' needs to truck the impure water off-site. Ecolochem, however, was hired only to produce demineralized water, not water that had been both demineralized and deoxygenated.

The Electrical Power Research Institute ("EPRI"), a research organization for the power industry, published new

guidelines in 1982, recommending the use of deoxygenated water in PWRs. These guidelines were soon implemented throughout the utility industry. In direct response to these guidelines, Edison asked Ecolochem to deoxygenate the make-up water used in SONGS. Shortly thereafter, Ecolochem began developing the patented process at issue in the instant case.

Once construction of the HFMUD was finished, Edison had no further need for Ecolochem's services, being able to now produce, on its own, sufficient, high purity, deoxygenated make-up water by passing the water through the HFMUD. The HFMUD passes the make-up water through a strong acid cation[1] resin bed, a predominantly weak base anion[2] resin bed, an activated carbon bed, a second strong acid cation resin bed, a strong base anion bed, and, finally, a vacuum deareator. This process removes suspended, undissolved solids and dissolved impurities, including salt, mineral ions, organic chemicals, and oxygen.

Ecolochem alleged that Edison's process, as described above, infringes its '411 patent. Ecolochem asserted all three independent claims of the '411 patent, and multiple dependent claims. The independent claims read as follows:

1. A deoxygenation process comprising a first step of contacting a liquid contacting [sic] dissolved oxygen and hydrazine with a bed of activated carbon to catalyze a reaction between said dissolved oxygen and a portion of said hydrazine, whereby an amount of dissolved carbon contaminants is added to said liquid, and a second step of removing said contaminants and said unreacted hydrazine that com-

---

[1] Cation: An ion having a positive charge. *See Webster's Ninth New Collegiate Dictionary* 216 (1990).

[2] Anion: An ion having a negative charge. *See Webster's Ninth New Collegiate Dictionary* 87 (1990).

prises passing said liquid through a strong acid cation exchange resin and a strong base anion exchange resin.

15. A deoxygenation process comprising a first step of contacting water containing dissolved oxygen and hydrazine with a bed of activated carbon to catalyze a reaction between said dissolved oxygen and a portion of said hydrazine, whereby an amount of dissolved and undissolved activated carbon contaminants are added to said water, a second step of removing said dissolved contaminants and said unreacted hydrazine by passing said water through a strong acid cation exchange resin and a strong base anion exchange resin, said water being at a temperature above the freezing point of water and below a temperature that would damage said resins, removing said undissolved contaminants by passing said water through a filter whereby said undissolved contaminants are filtered from said water, and a fourth step of circulating said water in a power generating apparatus after said removing step.

20. A deoxygenation process comprising a first step of contacting a liquid containing dissolved oxygen and hydrazine with a bed of activated carbon to catalyze a reaction between said dissolved oxygen and said hydrazine, whereby an amount of dissolved activated carbon contaminants is added to said liquid, and a second step of removing at least said dissolved contaminants by passing said liquid through a strong acid cation exchange resin and a strong base anion exchange resin.

Asserted claims 3-13 depend on claim 1. Asserted claims 17 and 18 depend on claim 15. Claim 20 is independent, and no claims dependent thereon are asserted.

All asserted claims in suit recite a deoxygenation process for removing dissolved oxygen from a liquid. In representative claim 20, liquid containing oxygen and hydrazine passes through activated carbon, thus catalyzing a reaction between

the oxygen and hydrazine, whereby an amount of dissolved carbon contaminants falls out of the reaction and is added to the liquid. Then the liquid passes through ion exchange resins, including both strong acid cation and strong base anion exchange resins,[3] to remove at least the dissolved contaminants. The invention of independent claim 1 is similar, except that the resins also remove any unreacted hydrazine. Claims 3 through 6 and claims 10 through 13 require further steps in the deoxygenation process, e.g., filtration. Claim 7 requires the temperature of the liquid to be above the liquid's freezing point, and below the temperature at which the resins would be damaged. Claim 8 requires the liquid to be water. Claim 9 requires that the liquid of claim 1 be water and that the water be circulated in a power generating apparatus. Independent claim 15 recites a combination similar to claim 9, and claims 17 and 18 add hydrazine and demineralize the water.

The '411 patent issued in 1989 from a continuation of an application which issued as the '492 patent on December 5, 1985. Both the '411 and '492 patents are entitled "Deoxygenation Process." At the outset of this litigation, Ecolochem asserted claims under both the '492 and '411 patents.

On September 1, 1994, Judge Gadbois, the original trial judge, granted-in-part and denied-in-part Edison's motion for summary judgment seeking to invalidate various asserted claims of Ecolochem's patents. *See Ecolochem, Inc. v. Southern Cal. Edison Co.,* 863 F.Supp. 1165 (C.D.Cal.1994). Judge Gadbois held claims 1, 2, and 5-10 of the '492 patent and claims 20 and 21 of the '411 patent to be invalid as either obvious and/or anticipated. Ecolochem

---

[3] A cation/anion exchange resin is a resin which, when brought in contact with liquid containing cation/anion contaminants, removes them.

appealed the partial summary judgment as to claims 1, 2, 5-7, and 10 of the '492 patent and claim 20 of the '411 patent. Ecolochem did not appeal the findings of invalidity of claims 8 and 9 of the '492 patent or claim 21 of the '411 patent. We affirmed the district court's holdings of anticipation of claims 1, 2, 5, and 6 and obviousness of claims 7 and 10 of the '492 patent. We reversed the summary judgment of obviousness of claim 20 of the '411 patent and remanded the case for a trial weighing the secondary consideration evidence as to claim 20. *See Ecolochem, Inc. v. Southern Cal. Edison Co.,* No. 95-1320, 91 F.3d 169, 1996 WL 297601 (Fed. Cir. June 5, 1996) (table).

Upon remand, the case was randomly reassigned to Judge (now Circuit Judge) Richard A. Paez[4] to conduct a trial on claim 20 and the remaining claims upon which summary judgment had not been granted in the earlier district court decision. Ecolochem asserted infringement with respect to claims 1, 3-13, 15, 17, 18, and 20 of the '411 patent. *See Ecolochem, Inc. v. Southern Cal. Edison,* No. 92-3436, 1998 WL 1182000, (C.D.Cal.1998) ("Ecolochem"). After a bench trial, Judge Paez found that Edison had willfully infringed claims 1, 3-13, 15, 17, 18, and 20 of Ecolochem's '411 patent. Judge Paez, however, held claims 1, 3-13, 15, 17, 18, and 20 of the '411 patent to be invalid for obviousness and claims 1, 4, 7-12 and 20 also to be invalid as anticipated.

Ecolochem appeals the rulings of the district court that claims 1, 4, 7-12, and 20 were anticipated and that the inventions of claims 1, 3-13, 15, 17, 18, and 20 would have been obvious. Edison does not cross-appeal the district court's findings of willful infringement.

---

[4]On March 9, 2000, the Senate confirmed the nomination of Judge Richard A. Paez to the United States Court of Appeals for the Ninth Circuit.

We have jurisdiction under 28 U.S.C. § 1295(a)(1) (1994).

ANALYSIS

I. Anticipation

A. The Martinola Reference

The district court found claims 1, 4, 7-12, and 20 of the '411 patent to be anticipated by either of two articles, one published in 1980 and the other in 1981, by Dr. Friedrich Martinola and a co-author, both of which are entitled "Saving Energy by Catalytic Reduction of Oxygen in Feedwater." *See* Dr. Friedrich Martinola & P. Thomas, *Saving Energy by Catalytic Reduction of Oxygen in Feedwater, in Proceedings of the 41st International Water Conference Pittsburgh* 77 (1980); Dr. Friedrich Martinola and P. Thomas, *Saving Energy by Catalytic Reduction of Oxygen in Feedwater, in Effluent and Water Treatment Journal* 542 (December 1981).[5] Because these two articles are in most aspects identical, we refer to them together throughout as "the Martinola reference." We review the district court's decision on anticipation after trial for clear error. *See Lindemann Maschinenfabrik GMBH v. American Hoist and Derrick Co.*, 730 F.2d 1452, 1462, 221 USPQ 481, 488 (Fed.Cir.1984).

The district court focused on Figure 10 of the Martinola reference (which is the same figure in both articles). Figure 10 shows a few possible uses for deoxygenated water, such as supplying make-up water for boilers, or for nuclear reactors. The figure is essentially a flow chart indicating various ways for the water to be deoxygenated, depending on the potential destination of the water. Water designated for nuclear reactors is shown flowing through three steps:

---

[5]The International Water Conference is an annual convention focusing on water treatment issues.

demineralization, and then a two-step deoxygenation process, which is accomplished by passing the water through a catalyst column and a mixed bed.[6] The district court interpreted Figure 10 as showing that the catalyst column can contain either the Lewatit catalyst or activated carbon. The district court found that the reactant can be either hydrogen or hydrazine.

On the face of the 1980 Martinola article, which fails to provide a detailed description of Figure 10, there is a bold heading reading: **Application of oxygen reduction in water with hydrogen.** Beneath this heading are two paragraphs of text, followed by Figure 10. The text reads:

> The process is recommended wherever the heat used for thermal degassing cannot be recovered. It will therefore be primarily used where the work has to be carried out at ambient temperature or where there is no heating steam available. Fig. 10 shows a few suggested applications. It also includes systems for the simultaneous treatment of water with ion exchange resins and oxygen reduction with catalysts.

Martinola at 81-82 (1980). The 1981 article, on the other hand, has no bold headings, but discusses Figure 10 in more detail. The paragraph directly following Figure 10 reads:

> [T]he application of hydrogen to reduce oxygen in water is recommended wherever the heat used for thermal degassing cannot be recovered. It will therefore be primarily used where the work has to be carried out at ambient temperature or where there is no heating steam available. Figure 10 shows a few suggested applications.

---

[6] A mixed bed is a resin bed which, when brought in contact with liquid containing cation and/or anion contaminants, removes them. In other words, a resin bed containing a mixture of cation and anion resins.

Martinola at 546 (1981). The latter description clarifies that Figure 10 is not meant to illustrate the use of either hydrogen or hydrazine, but only hydrogen, contrary to the findings of the district court in the instant case. This is particularly apparent when we examine the differences between the two articles. The heading in the 1980 article clearly illustrates that Figure 10 refers only to hydrogen, and the discussion in the text explains only that Figure 10 shows a few applications. The 1981 article does not limit Figure 10's applications to hydrogen through a heading, but states clearly in the text ("the application of hydrogen to reduce oxygen. . . . Figure 10 shows a few suggested applications.") that the suggested applications are for the utilization of hydrogen to reduce oxygen in water.

We hold that the district court clearly erred in finding that the articles anticipate claims 1, 4, 7-12, and 20 of the '411 patent. Each article is entitled "Saving Energy by Catalytic Reduction of Oxygen in Feedwater." Each article discusses methods to deoxygenate water, dividing the methods in use at the time of the article into physical processes (vacuum degassing at low temperatures and pressure degassing at high temperatures), and chemical processes (reduction with sulfite, hydrazine or hydrogen). The articles state that the physical processes (or thermal degassing) have been the most common method of deoxygenating, as the chemical processes are expensive, slow to react at low temperatures, and contaminate the water by adding salts. The articles then state that the chemical process of deoxygenating water with hydrazine had been in use, but that the chemical process of deoxygenating water with hydrogen had not been, and concludes that the hydrogen process is preferable.[7] At the end

[7]The '411 specification explains further that "[i]n the prior art deoxygenation [sic] processes, hydrazine has been used as a strong reducing agent to prevent corrosion and other problems associated with oxygenated water." '411 pat., col. 1, ll. 27-30. A review of the prior art

of the articles is a comparison of the thermal degassing method, the hydrazine method, and the hydrogen method. The articles state that:

> Precondition for the proper use of hydrazine is the pH-value of the water to be higher than 8.5, because only in this range the reaction with oxygen takes place with sufficient rate .... When applying activated carbon as a catalyst in the removal of oxygen with hydrazine at ambient temperatures it has to be taken into account that the carbon releases salts into the demineralized water.

Martinola at 81 (1980); Martinola at 545-46 (1981). The articles then conclude that "[i]f we compare the final costs for all three processes . . . we find that the method of oxygen reduction with hydrogen is much cheaper than the other methods. The required apparatus is also simple and needs virtually no maintenance." Martinola at 81 (1980); Martinola at 546 (1981). This conclusion is followed by a discussion of how to use water deoxygenated by hydrogen in different industries, as illustrated by Figure 10. Only in that discussion is there a suggestion to follow the catalyst column with a mixed bed if one plans to use water deoxygenated by hydrogen in nuclear power plants. The articles do not discuss the use of water deoxygenated by any other method in nuclear power plants. The articles' discussion of applications of deoxygenated water is limited to the use of hydrogen deoxygenation.

The district court in the instant case disagreed with the earlier discussion of the Martinola reference by the district court in *Ecolochem, Inc. v. Mobile Water Tech. Co.*, 690 F.Supp. 778 (E.D.Ark.1988), aft' d, 871 F.2d 1096,

---

indicates that small amounts of hydrazine were used in the final stage of deoxygenation, after the thermal degassing or other chemical process had been used, to remove the last traces of oxygen, while keeping to a minimum the contaminate byproducts of the hydrazine process.

10 USPQ2d 1557, 1989 WL 16031 (Fed.Cir.1989) (table). In the earlier case, the district court held that: [t]he diagram found on page 82 of the Martinola article is under the bold-faced heading "Application of oxygen reduction in water with *hydrogen." [See* Martinola at 81 (1980)] (emphasis supplied). Thus, the diagram refers to applications of the process the authors are trying to promote — the palladium/hydrogen catalysis — and not the hydrazine process which is discussed in a separate section.

This conclusion is buttressed by the fact that the palladium/hydrogen process may also release ionic impurities into the effluent, *see id.* at 79 ("traces of chlorides or other ions may be released"), thus necessitating a downstream ion exchange resin when high purity deoxygenated water is required .... Nothing in the Martinola reference expressly teaches the use of a mixed bed ion exchange resin following the hydrazine/carbon process.

Id. at 781-82. This is to be contrasted with the district court in the instant case, which wrote:

> [T]he Court respectfully disagrees with the district court's conclusion in *Mobile Water* that because Diagram 10 is positioned on the page following the heading "Application of oxygen reduction in water with hydrogen" and the associated text, Diagram 10 necessarily refers exclusively to reduction of oxygen in water with hydrogen and not to reduction of oxygen with hydrazine in an activated carbon column .... There is no room for Figure 10 at the bottom of page 81 because Figure 9 extends too far down the page. Following Figure 9 is a brief conclusion to the article, in which the authors recommend use of the Martinola system whenever deoxygenation is to be carried out at ambient temperatures .... Thus, Figure 10 refers generally to methods of deoxygenating and purifying water.

The district court clearly erred by misconstruing Figure 10's relationship to the text of the article. As discussed above, this becomes even clearer once we examine the difference between the two articles. Dr. Martinola and his co-author very carefully made sure in both the 1980 article, through the heading, and the 1981 article, through the language, that Figure 10 refers only to hydrogen and not to hydrazine. The authors would not have been so careful with the language in the 1981 article if they had not meant for Figure 10 to come under the "hydrogen-only" heading in the 1980 article. We disagree with the district court in this case that the publishers rather than the authors chose where to place Figure 10. Rather, we agree with the Arkansas district court that the authors intended the placement of Figure 10 under the hydrogen-only heading, and that Figure 10 therefore only refers to applications of the palladium/hydrogen catalysis. The district court, we hold, clearly erred in finding that Martinola anticipates deoxygenation by hydrazine in combination with a mixed bed. Consequently, we reverse the district court's finding that the Martinola reference was proven by clear and convincing evidence to have anticipated certain of the asserted claims of the '411 patent.

B. The Martinola Presentation

The district court also found the same claims — 4, 7-12, and 20 — of the '411 patent to be anticipated by a public presentation made by Dr. Martinola at the International Water Conference in Pittsburgh in October 1980. Specifically, the district court found that "Martinola stated at his deposition that during his presentation at the 1980 conference he used Figure 10 of his diagram [sic] as a slide and discussed 'the use of a mixed bed ion exchange resin after hydrazine and activated carbon' for the same purposes and uses described in Ecolochem's patents." *Ecolochem,* at *40

(quoting Martinola Dep. at 18:16-19:6). Finding this to be undisputed, the district court found that this testimony established that the Martinola presentation, like his articles, anticipated the above claims of Ecolochem's '411 patent. *See id.*

Ecolochem argues that "Dr. Martinola's oral presentation must stand or fall with the article as allegedly anticipatory prior art, since Dr. Martinola could not remember in 1992 what he had said twelve years earlier." Appellant's Br. at 35. We do not agree that the presentation, in and of itself, cannot anticipate claims of the '411 patent. Section 102 provides that "a person shall be entitled to a patent unless . . . the invention was known or used by others in this country." 35 U.S.C. § 102(a) (1994). A presentation indicative of the state of knowledge and use in this country therefore qualifies as prior art for anticipation purposes under § 102. Furthermore, whether Dr. Martinola correctly remembered his presentation twelve years later is an issue of credibility, on which we review the district court's finding with deference. The district court found, based on Dr. Martinola's testimony, that Figure 10 was indeed presented in 1980 by Dr. Martinola with an explanation that it was addressing the use of hydrazine.

The key element of the presentation, found by the district court to anticipate the claims of the '411 patent, is Figure 10. We first note that both independent claims 1 and 15 differ from independent claim 20 in contemplating that the final ion exchange step will remove not only dissolved carbon contaminants, but also any excess hydrazine that has not reacted with the dissolved oxygen in the water. Claims 4 and 7-12 (which all depend on claim 1) also require the additional step of removing the excess hydrazine. According to his deposition testimony, Dr. Martinola discussed the removal of the dissolved carbon contaminants at the 1980 presentation, but not the removal of excess, i.e., unreacted,

hydrazine.[8] This omission renders clearly erroneous the district court's finding that claims 1, 4, and 7-12 were anticipated by Dr. Martinola's presentation, and consequently we reverse that finding.

Therefore, the only claim that could be anticipated is claim 20, which claims a deoxygenation process comprising the steps of passing liquid containing oxygen and hydrazine through activated carbon, and then passing the liquid through ion exchange resins, including both strong acid cation and strong base anion exchange resins, to remove at least the dissolved contaminants. This is the exact process described by Dr. Martinola's presentation of Figure 10. We therefore affirm the district court's finding of anticipation of claim 20 of the '411 patent as not clearly erroneous.

II. Obviousness

The district court also held that the inventions of claims 1, 3-13, 15, 17, 18, and 20 of the '411 patent would have been obvious in light of the "combination of the Houghton process for deoxygenation with a mixed bed ion exchange resin to remove excess hydrazine and/or dissolved and/or undissolved carbon contaminants." We review the district court's conclusion of obviousness *de novo*. We affirm the district court's conclusion of obviousness with regard to claim 20, and reverse the holding that obviousness was proven by clear and convincing evidence with regard to all other claims at issue.

---

[8] Dr. Martinola testified that, during his presentation, he described his paper as showing:
[T]hat you can apply activated carbon as a catalyst and it will remove oxygen with hydrazine; but it has to be taken into account that the carbon releases salts in the demineralized water, and, afterwards, in Figure 10, there is shown a system with a catalyst column and a mixed bed. Martinola Dep. at 18:6-12.

A. The Houghton Process as a "Blueprint'

The district court essentially found that the most innovative aspect of Ecolochem's process was its "[u]nearthing [of] long-neglected art," holding that "Ecolochem's good fortune in obtaining the Houghton reference just as the EPRI guidelines created increased attention in the PWR industry to the problem of ambient temperature deoxygenation does not entitle Ecolochem to patent protection."

Houghton was the co-author of a paper on deoxygenation by carbon catalysis of the reaction between hydrazine and dissolved oxygen, entitled "The Use of Active Carbon With Hydrazine in the Treatment of Boiler Feed Water" ("the Houghton article"). The Houghton article was presented at the 1957 International Water Conference at Bournemouth, England and brought to the attention of Ecolochem at the 1982 International Water Conference.[9] The Houghton article peaked the interest of Ecolochem, and its scientists began performing experiments to determine if the results predicted in Houghton's paper could be replicated in a laboratory setting. Ecolochem's scientists were skeptical, because they "had understood that hydrazine reacted very slowly with dissolved oxygen and one of [their] objectives in [the] preliminary experimentation was to run the process to

---

[9] William Miller, one of the inventors of the deoxygenation process described in the '411 patent, testified that he attended the International Water Conference in 1982 "with the intention of finding alternative deoxygenation processes, if there were any." Miller Decl. ¶19 (Oct. 28, 1997), J.A. at 931. By alternative, Mr. Miller was referring to processes other than deoxygenation through the use of a vacuum degasifier. While at the conference, Mr. Miller spoke to an Ecolochem area sales manager, John Pugsley. Mr. Pugsley worked for the Florida Power and Light Company before he came to work for Ecolochem and he recalled that someone at Florida Power and Light was doing some work on deoxygenation involving carbon. As a result of that conversation, Mr. Pugsley arranged for someone at Florida Power and Light to send me [the Houghton article]. *Id.*

determine if the Houghton process sufficiently catalyzed the reaction." Miller Decl. ¶22. The tests supported the Houghton article, but also revealed the presence of ionic substances in the deoxygenated water coming out of the carbon bed. Houghton did not discuss the ionic contamination. Ecolochem performed subsequent tests to assess its attempts to reduce the presence of the ionic substances, and after considerable experimentation, eventually succeeded with the patented process after more research and considerable experimentation. The district court found that "for years it had been known in the art of water treatment that activated carbon releases ionic substances into water," but that Ecolochem's scientists, who the district court found had been employed in the water treatment industry for over a decade by the time the patent issued, were unaware of this contamination at the time they conducted their experiments.

The district court recognized that the Houghton reference did not anticipate the patent, but felt that:

> Taken together, the prior art references relevant to Ecolochem's invention disclose all of the elements of the claimed invention, and their combined teachings would have suggested to one of ordinary skill in the art that the Houghton process could be followed by the use of mixed bed ion exchange resins to provide ambient temperature deoxygenation and remove excess hydrazine as well as dissolved and undissolved carbon contaminants.

"A patent may not be obtained . . . if the differences between the [claimed invention] and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. § 103(a) (Supp. 111 1997). Our analysis of the patentability of Ecolochem's invention begins with the phrase "at the time the invention was made." Here, the date of the invention is presumed to

be the filing date of the parent application, December 16, 1983.

In *In re Dembiczak,* we noted that:

Measuring a claimed invention against the standard established by section 103 requires the oft-difficult but critical step of casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. *In re Dembiczak,* 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed.Cir.1999). We "cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." *In re Fine,* 837 F.2d 1071, 1075, 5 USPQ2d 1596 (Fed.Cir.1988).

Our case law makes clear that the best defense against hindsight-based obviousness analysis is the rigorous application of the requirement for a showing of a teaching or motivation to combine the prior art references. *See Dembiczak,* 175 F.3d at 999, 50 USPQ2d at 1617. "Combining prior art references without evidence of such a suggestion, teaching, or motivation simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability — the essence of hindsight." *Id.*

"When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references." *In re Rouffet,* 149 F.3d 1350, 1355, 47 USPQ2d 1453, 1456 (Fed.Cir.1998) (citing *In re Geiger,* 815 F.2d 686, 688, 2 USPQ2d 1276, 1278 (Fed.Cir.1987)). The same principle applies to invalidation. "Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." *ACS Hosp. Sys., Inc. v. Montefiore Hosp.,* 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed.Cir.1984).

Although the suggestion to combine references may flow from the nature of the problem, see *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed.Cir.1996), '[d]efining the problem in terms of its solution reveals improper hindsight in the selection of the prior art relevant to obviousness," *Monarch Knitting Mach. Corp. v. Sulzer Morat Gmbh,* 139 F.3d 877, 880, 45 USPQ2d 1977, 1981 (Fed.Cir.1998). Therefore, "[w]hen determining the patentability of a claimed invention which combines two known elements, 'the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination.' " *In re Beattie,* 974 F.2d 1309, 1311-12, 24 USPQ2d 1040, 1042 (Fed.Cir.1992) (quoting *Lindemann,* 730 F.2d at 1462, 221 USPQ at 488).

In this case, the district court used the '411 patent as a blueprint, with the Houghton process as the main structural diagram, and looked toother prior art for the elements present in the patent but missing from the Houghton process. The district court opinion does not discuss any specific evidence of motivation to combine, but only makes conclusory statements. "Broad conclusory statements regarding the teaching of multiple references, standing alone, are not 'evidence.' "

Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617. The district court provides no support for its broad conclusory statement that it was known in the art that a carbon bed, as used in the Houghton process, would produce water with high levels of conductivity caused by the presence of ionic contaminants. Nor does the district court then provide support for its implicit finding that given water so contaminated, it would be obvious to one of ordinary skill in the art to place a mixed bed ion exchange resin downstream of the carbon bed. In fact, nowhere does the district court particularly identify any suggestion, teaching, or motivation to

combine the Houghton process with a mixed bed ion exchange resin to achieve the patented process.

The district court avoids the issue, and makes implicit findings, but can point to nothing that suggests the combination of deoxygenation and demineralization processes that comprise Ecolochem's invention. For instance, the district court finds that Ecolochem "did not try any other way to remove the ionic contaminants leached by the carbon bed other than adding the mixed bed," and that "[t]here is no evidence that any system for production of ultra-pure water ever included a carbon bed as the final step in water treatment." In addition, the district court makes the unsupported finding that "[m]any in the art knew as of 1982 that carbon beds leached contaminants which could be removed by ion exchange." In support of this statement, the district court relies upon the Martinola reference, and U.S. Patent No. 4,430,226 ("the '226 patent") for a disclosure that "activated carbon leaches dissolved contaminants." For the disclosure of the "removal of dissolved carbon contaminants by ion exchange", the district court relied upon the '226 patent and John W. Hassler's 1974 article "Purification with Activated Carbon," which do state that with some types of carbon, "ion-exchange resins have been employed to remove inorganic compounds, alkalinity, or acidity not absorbable by activated carbon." J.A. at 1893. However, while these references teach the leaching of dissolved contaminants by activated carbon and the use of ion-exchange resins to remove carbon contaminants, neither reference suggests combining, nor provides any motivation to so combine, the two elements of the Ecolochem process, i.e., deoxygenation of the water by the Houghton process and demineralization of the water by the mixed bed.

The district court seems to find that the Martinola reference implicitly suggests the combination of the two elements, but discounts "[t]he fact that Martinola did not

make Ecolochem's invention, and instead focused on the hydrogen-palladium method of deoxygenation [a] s not relevant." The district court clearly erred in this regard. This fact is completely relevant to the obviousness analysis, since Martinola actually teaches away from combining at least one of the Martinola articles with the Houghton process to achieve Ecolochem's claimed process. While the Martinola reference describes a hydrogen and Lewatit-based deoxygenation process and mentions deoxygenation by carbon catalysis of a hydrazine/oxygen reaction, it does so only for comparative purposes. The Martinola reference actually unfavorably compares the hydrazine/carbon process, saying that it "releases salts into the demineralized water" and that the hydrogen-based process is energy saving and significantly less expensive.[10]

The Martinola reference is not the only reference that points to problems and concerns with the Houghton process. The Houghton article was challenged from the day it was presented, when an audience member asked whether the process could produce water with acceptable amounts of silica. Houghton responded that contamination was a concern with his process, and both this inquiry and the response

---

[10]The 1980 article states:

A large number of chemical compounds can be used for reducing the elementary oxygen in water .... Until now, however, they have merely been used for the residual degassing that follows on from thermal processes. The reasons for this are the high costs involved, the slowness to react at low temperatures and the additional introduction of salts into the water. For the elimination of oxygen in boiler feedwater and hot water, use has been made for a long time now of hydrazine in the form of hydrazine hydrate .... A particularly simple process, which takes place in particularly well-known stages and is also energy-saving, is the reaction between the dissolved oxygen and hydrogen gas introduced into the water .... If we compare the final costs for [the different methods] we find that the method of oxygen reduction with hydrogen is much cheaper than the other methods. The required apparatus is also simple and needs virtually no maintenance. Martinola at 77-81 (1980).

were published with the paper in a section entitled "Discussion." Another paper published contemporaneously with the Houghton article states that:

> if an activated carbon-bed is used to accelerate the oxygen/hydrazine reaction, it is particularly important that no trace of carbon should enter the boiler . . . [i]f it is considered essential that the hydrazine and oxygen should react before entering the boiler, then the use of ultra-violet light is a promising means of accelerating the reaction, without introducing any impurities into the system.

S.R.M. Ellis, C. Moreland, *The Reaction Between Hydrazine & Oxygen, in The Account of the Proceedings of the International Conference held at Bournemouth, 15th-17th May 1957* 8, 21 (1958). In 1960, T.F. Demmitt prepared a "Preliminary Report on the Use of Activated Carbon as a Catalyst for the Dissolved Oxygen-Aqueous Hydrazine Reaction." Demmitt stated that "[m]agnetite would be more desirable than activated carbon since there would be no tendency to 'deactivate' magnetite in filtered water," and thereby taught away from the idea of using a carbon bed as the catalyst.

J.A. at 1696H. In 1962, a paper was presented at the International Water Conference, stating that research had shown two methods "to remove oxygen to sufficiently low levels with adequate capacities be practical." Piero Sturla, *Polishing Condensate and Dearating by Ion Exchange* at 63 (1962). Neither of these methods was based on the Houghton process. These two methods were still being used in 1977, when Culligan (a water treatment company) recommended one of the two in an internal memo for use in portable containers, and the challenges continued through the time of the invention. Even Ecolochem's scientists themselves testified that, prior to their successful tests, they

did not believe they would be able to replicate the results stated in the Houghton article.

Furthermore, the district court found even the mixed bed, of which the use "to remove carbon contaminants was well known in the field," had detractors. Edison's own engineers testified that they considered:

> a four-bed [a primary cation bed, a primary anion bed, a secondary cation bed and a secondary anion bed] system superior to . . . a three-bed system [a cation bed, an anion bed and a mixed bed] . . . because of the problems that Edison had encountered in regenerating the mixed bed, . . . and based on . . . personal experience that four-bed systems generally outperformed mixed bed systems in producing pure water.

There is clear evidence of teaching away in the prior art from both the demineralization process and the deoxygenation process used by Ecolochem, and no evidence that there was any suggestion in the prior art to combine these two processes, yet the district court finds the '411 patent obvious in light of the prior art.

The absence of a convincing discussion of the specific sources of the motivation to combine the prior art references, particularly in light of the strength of prior art teaching away from the use of the Houghton process, is a critical omission in the district court's obviousness analysis, which mainly discusses the ways that the multiple prior art references can be combined to read on the claimed invention. For example, the district court finds that the invention of claim 20 would have been obvious, and that, although claims 1 and 15 differ from claim 20, "[e]ach of the additional steps of claims 1 and 15 is disclosed in the prior art." The opinion then lists each step and states where in the cited prior art references the step can be found. This reference-by-reference, limitation-by-limitation analysis

wholly fails to demonstrate how the prior art teaches or suggests the combination claimed in the '411 patent.

With hindsight, we could perhaps agree that the Houghton article seems like an obvious place to start to address the need in the power plant industry for an improved carbon-catalyzed deoxygenation process employing hydrazine that can be used commercially in a variety of applications. But, "obvious to try" is not the standard. As embodied in the '411 patent, the process would secure for the art all of the advantages that catalyzation of a reaction normally provides without prohibiting its use due to all of the incumbent disadvantages associated with the use of hydrazine. However, the incumbent disadvantages associated with the use of hydrazine to deoxygenate water as described in the Houghton article include the release of unwanted impurities into the water, including dissolved substances such as salts, organic chemicals and suspended solids. As a result, the industry widely regarded the Houghton process as too impractical to be used for large amounts of water, or for high purity deoxygenated water. Under the conditions in which PWRs operate, even minute amounts of these contaminants can adversely affect generator integrity. Variations on this method had been tried, but discounted in favor of other deoxygenation processes. Dr. Martinola himself testified that at the time of his presentation he stated that the hydrazine method of deoxygenation led to contaminated deoxygenated water. See supra at I.B. Finally, the process not only worked, but worked better than expected, leading Edison to investigate "why Ecolochem's equipment can reduce [the organic concentration in the water] to less than 10 [arts] p[er] b[illion] with a device not designed to [do so]." Edison, in fact, gave four prospective bidders for the HFMUD construction job a tour of Ecolochem's equipment and shared "information about Ecolochem's process with others in violation of [Ecolochem's] secrecy agreement." Id. Only after this sharing of information and subsequent

testing was a prospective bidder able to develop the process used in the HFMUD, and accused by Ecolochem of infringing the '411 patent. The district court in fact found that the bidder's "proposed system ... effectively copied Ecolochem's deoxygenation process." This evidence undermines the district court's conclusion that Ecolochem's process would have been obvious to one of ordinary skill in the art.

Because we do not discern any evidentiary basis for the finding by the district court that there was a suggestion, teaching, or motivation to combine the prior art references cited against the claimed invention, the district court's conclusion of obviousness cannot stand. The implicit generalized finding by the district court that, when one of ordinary skill in the art was faced with the problem of deoxygenating water for use in a nuclear power plant and the Houghton article, the combination claimed by Ecolochem in the '411 patent would have been obvious is insufficient. We have previously held that "[t]he suggestion to combine may be found in explicit or implicit teachings within the references themselves, from the ordinary knowledge of those skilled in the art, or from the nature of the problem to be solved." *WMS Gaming, Inc. v. International Game Tech.*, 184 F.3d 1339, 1355, 51 USPQ2d 1385, 1397 (Fed.Cir.1999). However, there still must be evidence that "a skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." *In re Rouffet,* 149 F.3d at 1357, 47 USPQ2d at 1456; see also *In re Werner Kotzab,* 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed.Cir.2000) ("[A] rejection cannot be predicated on the mere identification ... of individual components of claimed limitations. Rather, particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the

manner claimed."). Here, there was no such evidence presented.

The only evidence on this issue presumes the very problem at hand — two experts testified that "if someone of ordinary skill in the art had been given the Houghton reference in 1982 and [if] they were asked to make it usable in a high-pressure power plant, they would have come up with Ecolochem's invention." Ecolochem, at *31 (emphasis added). The evidence available, however, indicates that if one of ordinary skill in the art had been given the Houghton reference, they would not have been inclined to use it, due to the large amount of teaching away, and the reliance in the industry on vacuum degasifiers to deoxygenate water. This finding by the district court presumes the knowledge acquired from Ecolochem's patent. We hold that the district court's finding that a skilled artisan would combine these references was clearly erroneous, and we hold that on this record the district court clearly erred in finding clear and convincing evidence of a suggestion to combine the prior art references, a suggestion to use the Houghton article as the backbone of the invention. Therefore, we reverse the district court's conclusion of obviousness with regard to claims 1, 3-13, 15, 17, and 18 of the '411 patent. As to claim 20, however, our prior decision mandates that we now undertake further analysis respecting its invalidation by the district court.

B. Prima Facie Case of Obviousness of claim 20

We previously held in our June 1996 non-precedential decision that:

> the district court clearly mischaracterized the import of Demmitt as a prior art reference for the determination of obviousness of claim 20. Demmitt . . . did not disclose the removal of carbon contaminants with an ion exchange resin. Despite the district court's mis-

> characterization of the importance of Demmitt, Ecolochem concedes that there is a "prima facie case of obviousness before Demmitt and there remains one after." However, Ecolochem argues that the secondary considerations, in this case, could rebut the prima facie case and that the district court wrongly failed to consider its evidence of secondary considerations and conclude that the evidence raised a genuine issue of fact requiring trial. We agree ... For the foregoing reasons ... the trial court's holding of obviousness of claim 20 of the '411 patent is reversed, and the case is remanded for trial on validity and infringement as to claim 20.

Given our earlier reliance on Ecolochem's concession of the *prima facie* obviousness of claim 20, which is binding as law of the case, we must treat claim 20 separately from the other claims held obvious in the decision appealed herein. We may only conclude that Ecolochem rebutted the prima facie case of obviousness with regard to claim 20 if the evidence of secondary considerations supports such a holding. *See id.; In re Piasecki,* 745 F.2d 1468, 1471, 223 USPQ 785, 787 (Fed.Cir.1984). We therefore review the district court's findings on the evidence of secondary considerations, and, for purposes of completeness, address whether and how this evidence affects the adjudicated invalidity of all other asserted claims.

C. Evidence of Secondary Considerations With Regard to All Claims

The idea that a patented invention might appear to be obvious given the excellent vision accorded by hindsight, but might not have been obvious at the time the invention was made, was discussed by the Supreme Court in *Graham v. John Deere Co.,* 383 U.S. 1, 17-18, 86 S.Ct. 684, 15 L.Ed.2d 545 (1966). In the intervening years since *Graham* a great

deal of attention has been paid to the importance of secondary considerations. We discuss below many of the secondary considerations used by the courts in an effort to compensate for hindsight. The Supreme Court held that "[s]uch secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy." 383 U.S. at 17-18, 86 S.Ct. 684 (internal citations omitted). While we review the district court's factual findings on the secondary considerations for clear error, we review the ultimate determination of obviousness *de novo. See B.F. Goodrich Co. v. Aircraft Braking Sys. Corp.*, 72 F.3d 1577, 1582, 37 USPQ2d 1314, 1317-18 (Fed.Cir.1996). We find clear error in the district court's findings on several of the secondary considerations as discussed below, but upon reviewing the obviousness conclusion *de novo,* hold that even if corrected, the findings respecting secondary considerations support the district court's holding of obviousness of claim 20 in the instant case. This conclusion has no effect on the obviousness of the inventions of claims 1, 3-13, 15, 17, and 18, which we have already held would not have been obvious given the absence of any motivation to combine the teachings of the cited prior art references. Ecolochem has, however, failed to rebut the conceded *prima facie* case of obviousness with regard to claim 20. We therefore affirm the district court's conclusion that the invention of claim 20 would have been obvious.

1. Long-Felt But Unsolved Need

The district court found that "[t]he findings of fact do not support Ecolochem's contention that there was a long-felt but unsolved need to create an ambient temperature deoxygenation process for use in start up and restart of nuclear

power facilities." It went onto hold that even if there had been such a need, the "required nexus between the claimed invention and the long-felt need is attenuated by the increased market demand resulting from adoption of the EPRI guidelines in 1982." *Id.*

Ecolochem argues that the 1982 EPRI guidelines merely reflected the acknowledged need for deoxygenated water that arose in the late 1970s and that the regulations only recommended, rather than required, deoxygenated water. Ecolochem further argues that there were reasons other than the issuance of these regulations for it to develop its processes. Furthermore, it argues that its mobile chemical process was the only way to meet this long-felt but unsolved need for deoxygenated water during the time required to build and install the permanent deoxygenators. Ecolochem argues that the guidelines (like emissions requirements for automobiles) were issued only after a long-felt need was realized, and that the regulations may have been unattainable at the time they were issued. Even Edison in its brief pointed out that Ecolochem had the only practical solution to the need of SONGS for deoxygenated and demineralized water before the completion of the HFMUD.

Our review of the district court's finding of no long-felt but unsolved need is for clear error, a deferential standard of appellate review. We cannot say the district court's finding that Ecolochem produced demineralized water in response to the guidelines issued by EPRI to be clearly erroneous. The record shows that the guidelines urging the use of deoxygenated water were issued in 1982, and Ecolochem filed for a patent on its deoxygenization process on December 16, 1983. This evidence supports the district court's finding that Ecolochem's process was developed not in response to a long-felt need in the power industry, but in response to a shortly-felt requirement imposed by EPRI's guidelines.

2. Commercial Success

We have previously held that a party cannot "demonstrate commercial success, for purposes of countering the challenge of obviousness, unless it can show that the commercial success of the product results from the claimed invention." *J.T. Eaton & Co. v. Atlantic Paste & Glue Co.*, 106 F.3d 1563, 1571, 41 USPQ2d 1641, 1647 (Fed.Cir.1997). We have further held that a presumption arises that the patented invention is commercially successful "[w]hen a patentee can demonstrate commercial success, usually shown by significant sales in a relevant market, and that the successful product is the invention disclosed and claimed in the patent." *Id.* In the instant case, Ecolochem offered evidence that its invention was practiced at 28 plants and generated almost $13 million in revenue from 1983 to 1990. Once Ecolochem made the requisite showing of nexus between commercial success and the patented invention, the burden shifted to Edison to prove that the commercial success was instead due to other factors extraneous to the patented invention. *See id.*

At trial, Edison countered that the commercial success of Ecolochem's process was due solely to the fact that it was part of a mobile apparatus, and that since none of the claims at issue include such a mobility limitation, the commercial success factor favors a finding of obviousness in the instant case. The district court found that both Edison and Ecolochem had carried their respective burdens, finding that the volume of Ecolochem's sales satisfied the requirements to show commercial success, but also that Edison proved the commercial success was due to factors other than those claimed. The district court explained:

> Ecolochem's limited commercial success with its patented process was primarily attributable to (1) Ecolochem's ability to meet the need in the PWR industry for short-term emergency services through its

> Mobile Flow service; (2) Ecolochem's ability to provide deoxygenation services while PWR plants built permanent deaeration equipment to meet new EPRI standards; (3) Ecolochem's head start in marketing mobile deoxygenation treatment services through use of its patented Mobile Flow trailer; (4) the increased blowdown rates that resulted from the 1982 tightening of EPRI guidelines for salts in the steam generator. In short, Ecolochem's commercial success was due not to the nature of the claimed invention, but to other economic and commercial factors unrelated to the technical quality of the patented process.

The district court's finding, however, ignores Edison's own statements to the contrary. Edison indicated in its briefs that it chose Ecolochem because the "first vendors Edison hired provided poor quality water and constantly shuttled demineralization trucks on and off Edison's property to meet Edison's capacity requirements." Appellee's Br. at 3. Edison's brief also states that Ecolochem's process "enabled it, unlike Edison's previous vendors, to regenerate its trailers on-site and provide purer quality water at the large volumes Edison needed." *Id.*

These statements make it clear that the commercial success of Ecolochem's product was, in fact, based on two factors: the improved filtration process, and the mobility of the commercial embodiment. Edison did not differentiate the improved filtration process from the patented process in any way, focusing only on the missing limitation of mobility in the claims at issue. The success was due to both the mobility, undisputedly not covered by the claims, and to the improved filtration process, undisputedly covered by the claims. Edison had the burden of disproving that the improved filtration process contributed to the success of the invention, and its own brief undermines its argument, by conceding the benefits of Ecolochem's filtration process. *See*

Ryko Mfg. Co. v. Nu-Star, Inc., 950 F.2d 714, 716, 21 USPQ2d 1053, 1055 (Fed.Cir.1991) ("To overturn a patent, the challenger must clearly prove those facts which support patent invalidity."). Consequently, the district court clearly erred in finding that Edison met its burden of proving that the success of the invention was due to factors not claimed in the patented invention.

3. Failure of Others to Make Invention

In evaluating this factor, the district court held that an unsolved problem is not evidence of non-obviousness unless skilled workers in the art have tried and failed to solve the problem. The district court then held that Ecolochem did not show that others had tried but failed to make Ecolochem's invention. See id.

Ecolochem cited a 1986 internal business memorandum circulated at Arrowhead, a competitor of Ecolochem's. In this memorandum, under the heading "OPPORTUNITY," Arrowhead wrote the following: "Ecolochem claims a proprietary process for deoxygenation and has exploited this market with little or no interference from Arrowhead. Markets exist primarily at the nuclear plants. Several approaches for deoxygenation exist . . . ." J.A. at 3049.

Edison, in turn, responded with testimony from its employees that when Edison discussed its deoxygenation needs with contractors in 1982, only two contractors mentioned chemical deoxygenation: Arrowhead and Ecolochem. Edison employees further testified that vacuum degasifiers were the industry standard, were reliable and economical, and that every other contractor stated that it intended to deoxygenate with a vacuum degasifier. There was no testimony as to whether Arrowhead succeeded in making a working chemical deoxygenation device. The district court evaluated Edison's testimony, and the absence of any testimony contradicting it, and found that no competitor had

attempted to employ a chemical deoxygenation process. The failure of others is therefore reduced to a credibility question, whether the district court believed the Edison employees. "This court gives great deference to the district court's decisions regarding credibility of witnesses." *Carroll Touch, Inc. v. Electro Mechanical Sys., Inc.*, 15 F.3d 1573, 1580, 27 USPQ2d 1836, 1842 (Fed.Cir.1993) *(citing Anderson v. City of Bessemer City,* 470 U.S. 564, 575-76, 105 S.Ct. 1504, 84 L.Ed.2d 518 (1985)). We cannot find it clearly erroneous on the part of the district court to have found no evidence of failure by others to make a chemical deoxygenation device or develop such a process.

4. Simultaneous Invention

"The fact of near-simultaneous invention, though not determinative of statutory obviousness, is strong evidence of what constitutes the level of ordinary skill in the art." *The Int'l Glass Co. v. United States,* 187 Ct.Cl. 376, 408 F.2d 395, 405 (1969). "[T]he possibility of near simultaneous invention by two or more equally talented inventors working independently, . . . may or may not be an indication of obviousness when considered in light of all the circumstances." *Lindemann*, 730 F.2d at 1460, 221 USPQ at 487.

The district court found that "prior to the issuance of Ecolochem's patent, Todd Hook of NWT independently combined the Houghton process with a mixed bed ion exchange resin, thereby independently developing Ecolochem's invention." Ecolochem argues that Mr. Hook testified at trial that the:

> idea embodied in his test apparatus, which combined the hydrazine/carbon process and ion exchange, was not his but Dr. Sawochka's. Dr. Sawochka, an acknowledged expert in the field, provided the system sketch and configured the test apparatus embodying the idea. Obviousness or nonobviousness to experts is irrelevant

> to obviousness under Section 103. Competing innovation by Dr. Sawochka may show bias but nothingmore.

Appellant's Br. at 56. Edison responds by stating that "as both Sawochka and Hook testified, Hook was left largely on his own in performing his project." Appellee's Br. at 53.

The issue of simultaneous invention is directly tied to the level of knowledge attributable to one of ordinary skill in the art. The district court weighed the testimony discussed above, and determined that there was evidence of simultaneous invention, and the fact that the one who performed the experiment was supervised by one of extraordinary skill in the art did not enhance the former's level of knowledge. Essentially, the district court found that this secondary consideration factor favors obviousness. As this was based on the district court's determination that Dr. Sawochka's and Mr. Hook's testimony was credible, we must give that finding great deference. Consequently, we cannot discern clear error in the finding of simultaneous invention by the district court.

5. Teaching Away

The district court found that "Ecolochem presented no evidence that the prior art expressed skepticism concerning the efficacy of using the Houghton process or of combining the Houghton process with ion exchange. Likewise, the Court's findings of fact establish that the prior art did not teach away from Ecolochem's invention." Ecolochem argued that the Houghton process had been around for decades and was not well known or regarded, citing a number of articles stating concerns with the Houghton process.

We previously found, in our unpublished June 1996 decision, that Ecolochem had put forth evidence "that various references taught away from the invention as they warned against the Houghton process because of the carbon

contaminants." *Ecolochem, Inc. v. Southern Cal. Edison Co.*, 1996 WL 297601. We discussed above the fact that Martinola teaches away from the Houghton process, as that reference found the process inefficient and expensive. We also discussed above the history of prior art teaching away from Houghton. Based on the body of evidence provided to the district court, we find clearly erroneous the district court's determination that the prior art did not teach away from using the Houghton process or from combining it with a mixed bed in any manner.

6. Copying and Acclamation

Another indicia of non-obviousness of a product is the acclamations it receives when it is released, and the copying that occurs. The district court found "that [although] Ecolochem's process was warmly received in the water treatment industry and was copied by at least two competitors, that copying did not result from the novelty of Ecolochem's invention and is of little weight in assessing obviousness."

Ecolochem argues persuasively that its device was copied because it was significantly less expensive than vacuum degasifiers, the only alternative in the field. Furthermore, testimony from Edison indicates that Ecolochem's process was better than its competitors'. The district court gives little credit to Ecolochem's arguments, finding only that the process was not novel. It is a factual determination as to what the exact reason for the copying was, but here we hold that it was clear error on the district court's part to discount the copying because the court believed that the process was not novel. Therefore, this factor cuts against a conclusion of obviousness.

We note, however, that a showing of copying is only equivocal evidence of non-obviousness in the absence of more compelling objective indicia of other secondary con-

siderations. See *In re GPAC,* 57 F.3d 1573, 1580, 35 USPQ2d 1116, 1122 (Fed.Cir.1995) (" '[M]ore than the mere fact of copying by an accused infringer is needed to make that action significant to a determination of the obviousness issue.' ") (quoting *Cable Elec. Prods. v. Genmark, Inc.*, 770 F.2d 1015, 1028, 226 USPQ 881, 889 (Fed.Cir.1985)). The reason is that the alleged copying "could have occurred out of a general lack of concern for patent property." *See Cable Elec. Prods.,* 770 F.2d at 1028, 226 USPQ at 889. Consequently, even though the district court clearly erred in stating that the copying was not connected to the patented aspects of the invention, its error does not carry great weight in our evaluation of the obviousness of the invention of claim 20 in light of all the secondary considerations, combined with the other evidence and findings on the prior art.

7. Weighing of the Factors

We must now weigh all the secondary considerations to determine whether the district court's error in not finding commercial success and teaching away, when aggravated by its error in failing to find copying; renders erroneous its conclusion that the invention of the claims at issue here would have been obvious. The district court did not clearly err in finding that there was no long-felt but unsolved need, that there was no failure by others to make the invention, and that there was a successful simultaneous invention by others. As explained above, the district court clearly erred in finding that the commercial success of Ecolochem's product was based only upon its mobility; that the prior art did not teach away from the Houghton process; and that there was no evidence of copying. However, only two of these factors are actually stated in *Graham;* the other falls under *Graham's* "etc." clause. The factors specifically mentioned in *Graham,* and those that we give the most weight to in the

instant case, are the commercial success of the invention, long-felt but unsolved needs, and failure of others to invent.

In our *de novo* obviousness review, we hold that the absence of any evidence that others were trying to emulate the patented process, and the fact that within two years of the publication of the EPRI guidelines Ecolochem had applied for a patent on the process, is more indicative of obviousness than the evidence of modest commercial success, and the teaching away from the use of the unmodified Houghton process is indicative of non-obviousness. The question of obviousness in the instant case is a close one, but we hold that the secondary considerations, taken as a whole, do not overcome the other evidence of obviousness.

Our earlier unpublished decision placed the burden on Ecolochem to rebut, based on all the secondary considerations, the *prima facie* case of obviousness with regard to claim 20. We cannot say that the district court erred in concluding that Ecolochem has not rebutted the *prima facie* case of obviousness with regard to claim 20.

However, for the remaining claims at issue, claims 1, 3-13, 15, 17, and 18, the secondary consideration evidence is but one of several factors, all of which must be assessed in determining obviousness. *See Graham,* 383 U.S. at 17-18, 86 S.Ct. 684.

Given the absence of any proof of a motivation to combine, we hold that the remaining claims were not proven obvious by clear and convincing evidence in light of the prior art.

CONCLUSION

For the reasons stated above, we affirm the district court's holding that it was proven by clear and convincing evidence that the invention of claim 20 would have been obvious and was anticipated, but reverse the district court's holdings that claims 1, 3-13, 15, 17, and 18 were proven invalid either as anticipated and/or obvious. We remand this case for award of damages, consistent with the district court's finding of willful infringement which stands. The decision, therefore, is

AFFIRMED-IN-PART, REVERSED-IN-PART, *and* REMANDED.

COSTS

Defendant shall pay costs.

Appendix B

APPENDIX B

United States District Court, C.D. California.

ECOLOCHEM, INC.,
Plaintiff,
v.
SOUTHERN CALIFORNIA EDISON,
Defendant.

No. 92 3436 RAP.

Sept. 18, 1998.

PAEZ, J.

INTRODUCTION

Ecolochem, Inc. ("Ecolochem") brings this action against Southern California Edison Company ("Edison") alleging willful infringement of Ecolochem's United States Patent No. 4,818,411 (" '411 patent"). Edison operates the San Onofre Nuclear Generating Station ("SONGS"). SONGS contains three nuclear reactors, each of which contains two water circulation systems. The primary water circulation system removes heat from the nuclear reactor. The heat from the primary system boils water in a secondary system, turning it into steam. The steam rotates a turbine connected to a generator, which produces electricity. The steam then condenses and recirculates through the secondary system.

Because the secondary system loses some of its water during each cycle, SONGS requires "make-up" water. Impurities in water circulated through the secondary system can damage steam generators, turbines and pipes. Consequently, Edison purifies the make-up water before adding it to the secondary system. Ecolochem asserts that Edison's method of producing high purity, deoxygenated make-up water under ambient temperature infringes its '411 patent.

The invention claimed in Ecolochem's '411 patent "pertains to a process for removing dissolved oxygen from liquids." '411 Patent, col. 1, l. 10-11. In essence, the invention describes a three-step process. First, hydrazine is added to a liquid containing dissolved oxygen. Second, the liquid is passed through an activated carbon bed to catalyze a reaction between the hydrazine and oxygen, producing water and nitrogen (N sub2 H sub4 + O sub2 =>2H sub2 O + N sub2). Ecolochem's first and second steps are drawn from prior art known as the Houghton process. Ecolochem's invention combines the Houghton process with a third step in which carbon contaminants introduced by the activated carbon catalyst, and/or excess hydrazine remaining after the reaction, are removed by passing the liquid through a strong acid cation exchange resin and a strong base anion exchange resin.

Having considered all of the evidence presented at trial, the arguments of counsel, and the parties' proposed findings of fact and conclusions of law, and having considered the credibility of all the witnesses, the Court now enters its findings of fact and conclusions of law, and orders that judgment be entered in favor of defendant Edison. The Court concludes that all of the asserted claims of Ecolochem's '411 patent are invalid for obviousness and that claims 1, 4, 7, 8, 9, 10, 11, 12 and 20 of the '411 patent are anticipated by Martinola. In order to resolve all factual disputes litigated at trial, the Court also finds if the '411 patent claims were valid, Ecolochem would be entitled to recover for Edison's willful infringement of the '411 patent. Given the history of this litigation and prior litigation involving the original patent, United States Patent No. 4,556,492, it is helpful at the outset to set forth the principle claims at issue, and to review the procedural posture of this case and the prior litigation.

THE '411 PATENT

The '411 patent claims a deoxygenation process for removing dissolved oxygen from water. Three independent claims of the '411 patent are at issue in this litigation. These claims read as follows:

1. A deoxygenation process comprising a first step of contacting a liquid contacting (sic) dissolved oxygen and hydrazine with a bed of activated carbon to catalyze a reaction between said dissolved oxygen and a portion of said hydrazine, whereby an amount of dissolved carbon contaminants is added to said liquid, and a second step of removing said contaminants and said unreacted hydrazine that comprises passing said liquid through a strong acid cation exchange resin and a strong base anion exchange resin.

15. A deoxygenation process comprising a first step of contacting water containing dissolved oxygen and hydrazine with a bed of activated carbon to catalyze a reaction between said dissolved oxygen and a portion of said hydrazine, whereby an amount of dissolved and undissolved activated carbon contaminants are (sic) added to said water, a second step of removing said dissolved contaminants and said unreacted hydrazine by passing said water through a strong acid cation exchange resin and a strong base anion exchange resin, said water being at a temperature above the freezing point of water and below a temperature that would damage said resins, a third step of removing said undissolved contaminants by passing said water through a filter whereby said undissolved contaminants are filtered from said water, and a fourth step of circulating said water in a power generating apparatus after said removing step.

20. A deoxygenation process comprising a first step of contacting a liquid containing dissolved oxygen and hydrazine with a bed of activated carbon to catalyze a reaction between said dissolved oxygen and said hydrazine, whereby

an amount of dissolved activated carbon contaminants is added to said liquid, and a second step of removing at least said dissolved contaminants by passing said liquid through a strong acid cation exchange resin and a strong base anion exchange resin.

'411 Patent, Claims 1, 15, and 20.

LITIGATION HISTORY

I. Prior Litigation.

Before this litigation commenced, Ecolochem pursued an infringement action against Mobil Water Technical Company ("Mobile Water") based upon Ecolochem's original patent disclosing the deoxygenation process at issue in this litigation, U.S. Patent No. 4,556,492 (the '492 patent). Ecolochem, Inc. v. Mobile Water Tech. Co, 690 F.Supp. 778 (E.D.Ark.1988), aff'd 871 F.2d 1096 (Fed.Cir.1989) (table)). Mobile Water conceded infringement of certain claims of the '492 patent. Id. at 786. The district court concluded after a bench trial on invalidity that the '492 patent was not anticipated by the prior art references before the court and that Mobile Water had failed to meet its burden of proof with respect to obviousness. Id. The Mobile Water court considered a number of prior art references:

1. Martinola, et al., "Saving Energy by Catalytic Reduction of Oxygen in Feedwater" in Proceedings 41 st International Water Conference, Engineering Society of Western Pennsylvania, 77-83 (1980) [hereinafter Martinola].

2. Bechtel Group, Inc., Guide to the Design of Secondary Systems and Their Components to Minimize Oxygen Induced Corrosion (1982) [hereinafter Bechtel].

3. Akol'zin & Kostrikira, Catalytic Oxidation of Hydrazine with Atmospheric Oxygen Dissolved in Water, UDC

546.171.5 (Woolcott & Co., Patent Translation Services) [hereinafter Akol'zin].

4. J.W. Hassler, Purification with Activated Carbon 51 (1974) [hereinafter Hassler].

5. U.S. Patent No. 3,985,648 (teaching combination of activated carbon filter followed by ion exchange to remove organic contaminants and protect exchange resins).

6. Demineralization Brings Down Cost of Pharmaceutical Manufacturing, Culligan Job Report No. 151 (same).

7. Ellis, Boiler Feedwater Treatment and Oxygen Scavengers, Chemical & Processing Engineering, March, 1955 at 79, 80 [hereinafter Ellis].

After reviewing the prior art, the court concluded that the difference between the prior art and the invention claimed in the '492 patent was the combination of separate components disclosed in the prior art into a single embodiment. Id. at 783. The court found that the level of ordinary skill in the art of water treatment and purification at the time of Ecolochem's invention was "scattered among different levels." Id. at 784. According to the Mobile Water court: "There exist a core of individuals with a high level of formal scientific education who keep abreast of developments in the art. The level of ordinary skill in the art is more modest. In particular, the person of ordinary skill does not possess a broad knowledge of developments in the art." Id.

Turning to secondary considerations, the Mobile Water court found "a long- felt but unsolved need for a deoxygenation process that resulted in very low dissolved oxygen concentations without adding impurities and that operated at low temperatures." Id. at 784-85. The court concluded that other deoxygenation methods, specifically deaerating condensers, vacuum degasifiers and sodium sulfite ion exchange, had drawbacks that meant a need still existed in the industry despite the available alternatives. Id. at 785. Look-

ing to Ecolochem's revenues, the court found Ecolochem had achieved substantial commercial success with the patented process. Id.

When the court turned to the legal question of obviousness, it concluded that Mobile Water had failed to offer sufficient evidence regarding the ordinary level of skill in the art and had therefore failed to meet its burden of proof on the defense of obviousness. Id. at 786. In addition, the court found that the secondary considerations "impel[led] a conclusion that the '492 Patent was not obvious." Id. at n. 9. On appeal, the Federal Circuit stated in an unpublished decision that the district court decision on obviousness reflected "a fully adequate consideration of the inquiries set out in Graham v. John Deere, 383 U.S. 1 (1966)."

In September, 1986, Arrowhead Industrial Water, Inc. filed a declaratory judgment action against Ecolochem seeking a declaration that the '492 patent was invalid on grounds of obviousness and anticipation. Ultimately, in 1994, Arrowhead and Ecolochem settled the case.

II. Procedural History.

At the outset of this litigation, Ecolochem asserted claims under both the '492 patent and its '411 patent. On September 1, 1994, Judge Gadbois granted in part and denied in part defendant's motion for summary judgment. Ecolochem v. Southern California Edison Co., 863 F.Supp. 1165, 1171 (C.D.Cal.1994). Judge Gadbois held that (1) genuine issues precluded the Court from resolving whether the term "deoxygenation process" in the two patents should be construed as requiring an extra-stoichiometric amount of hydrazine; (2) summary judgment of infringement was inappropriate because if Ecolochem prevailed on the factual issue regarding construction of the claims, a reasonable trier of fact could find Edison infringed the patents; (3) the Demmitt reference anticipated '492 claims 1, 5 and 6;

(4) questions of fact precluded summary judgment regarding whether Demmitt anticipated '492 claims 15 and 16; and (5) the invention described in claims 7, 10 of the '492 patent and 20 of the '411 patent was obvious in light of Demmitt. Id.

Ecolochem appealed the summary judgment as to claims 7 and 10 of the '492 patent and claim 20 of the '411 patent. See Ecolochem, Inc. v. Southern California Edison Co., 1996 WL 297601 (Fed. Cir. June 5, 1996). The Federal Circuit affirmed the findings of anticipation and obviousness with respect to the '492 patent but reversed the conclusion of obviousness as to claim 20 of the '411 patent. Id. at 1. The Circuit held that the district court had "mischaracterized the import of Demmitt as a prior art reference for the determination of obviousness of claim 20" in that Demmitt "did not disclose the removal of carbon contaminants with an ion exchange resin." Id. at 4. The Circuit concluded that Demmitt teaches no more than the Akol'zin reference, which disclosed use of the Houghton process with an ion exchange filter. In fact, the Circuit held that neither Demmitt nor Akol'zin "teach the use of a mixed bed resin to remove ionic impurities introduced by leaching from the activated carbon." Id. (citing Mobile Water, 690 F.Supp. at 782). As the Federal Circuit pointed out, claim 20 of the '411 patent "requires use of both cationic and anionic resins and can be read to require the removal of all dissolved carbon contaminants."

Although Judge Gadbois concluded that summary judgment on claim construction was inappropriate, in light of the Supreme Court's decision in Markman v. Westview Instruments, Inc., ____U.S. ____, 116 S.Ct. 1384, 1387 (1996), the Court revisited that decision and construed the claims of the '411 patent as follows:

The term "deoxygenation process" in the '411 patent means a series of functions used to reduce or eliminate oxygen dissolved in a liquid.

In so doing, the Court concluded that an alleged infringer need not use an extra-stoichiometric amount of hydrazine in order to infringe the deoxygenation process claimed in the '411 patent. Ecolochem has withdrawn its claims under the '492 patent and now asserts infringement only with respect to claims 1, 3-13, 15, 17, 18, and 20 of the '411 patent. See Def. Memo. at 1, n. 1.

FINDINGS OF FACT

I. Ecolochem, Inc.

1. Plaintiff Ecolochem, Inc. ("Ecolochem") is a mobile water treatment company whose principal place of business is Norfolk, Virginia.

2. Ecolochem supplies water purification and treatment services to plants in a number of businesses, including utilities, pulp and paper manufacturers, refineries, chemical manufacturers, electronics plants, contractors, and food processing plants.

3. Ecolochem provides a wide variety of water treatment services to its customers, including demineralization, softening, deoxygenation, filtration, chlorination and color removal, iron removal, pH adjustment and purification of various liquids.

4. In the 1980's, most of Ecolochem's customers were fossil fuel or nuclear power plants.

II. Edison And The San Onofre Nuclear Generating Station.

5. Defendant Southern California Edison Company ("Edison") is a utility that provides electricity to the South-

ern California area. Edison owns and operates a number of power plants, one of which is the San Onofre Nuclear Generating Station ("SONGS") in San Diego County, California.

6. SONGS is the only nuclear power plant operated by Edison.

7. The nuclear reactors at SONGS use nuclear fission, the splitting of atoms of uranium, to generate heat that is removed from a reactor by water in a pressurized, closed system called the primary system.

8. The heat from the primary system is used to boil water contained within a secondary system. The steam from the boiling water in the secondary system turns a turbine which is connected to a large generator that produces electricity.

9. The steam is then condensed in a sea-water cooled condenser, to return it to water, which is recirculated within the secondary system and the cycle is repeated.

10. SONGS includes three nuclear reactors or units to produce electricity.

11. Units 2 and 3 at SONGS are Pressurized Water Reactors ("PWRs") and each is equipped with two steam generators or boilers.

12. Prior to operation, Units 2 and 3 underwent a start-up phase in which they were tested, component by component, system by system, to verify compliance with safety and technical requirements of the plant. Start-up activities for Units 2 and 3 began in 1982.

III. The Need for Purified Water in PWRs.

13. A nuclear power plant requires high purity water. Unwanted impurities include dissolved substances such as salts, oxygen and organic chemicals, as well as suspended

solids. In particular, dissolved oxygen is a major contributor to most types of corrosion in ferrous metals.

14. Under the conditions in which PWRs operate, even minute amounts of these contaminants can adversely affect generator integrity.

15. Given the magnified adverse impact even minute amounts of contaminants can have on steam generators in PWRs, and the significant expense of power generating equipment, various steps are taken to limit the level of impurities in water systems of such plants and maintain extremely high purified water.

16. The production of high quality water often includes several treatment processes.

17. One basic and common process of water treatment at power plants is the removal of electrically charged atoms or molecules, known as ions, by means of a process known as ion exchange. Ion exchange resins work by replacing ions in water with other ions.

18. Ion exchange resins operate as follows: as the water passes through a bed of resin beads, ions from the water are taken up by the resin and replaced in solution by ions released from the resin. Cation resins exchange cations; anion resins exchange anions.

19. Ion exchange resins are generally configured in one of three basic systems: cation resins, which exchange cations, anion resins, which exchange anions, and mixed beds (containing a mixture of cation and anion resins), which remove both cations and anions.

20. The removal of salt and mineral ions from the water, through ion exchange, is generally referred to as demineralization.

IV. The Use of Make-Up Water at SONGS.

21. During operation of a PWR such as SONGS, a small amount of water must continuously be added to the secondary system to compensate for water lost from the system (on the order of 1/10 to 1/5 of 1% per cycle of recirculation). This supplemental water is referred to as make-up water.

22. Make-up water must also on occasion be added to the primary system, though at even lower rates than in the secondary system (less than 1/1,000 of 1% of the total water in the system).

23. Make-up water also may be used as auxiliary feedwater to the nuclear generator when the system starts up after having been non-operative for a period of time for maintenance or reactor refueling.

24. Make-up water is supplied from a make-up demineralization system, which takes source water from outside the plant and refines it to water of extremely high purity through "demineralization."

25. The domestic water supply at SONGS comes from the Municipal Water District of Orange County.

26. Water from the Orange County Municipal Water District contains many chemical contaminants. Accordingly, it must be treated prior to entering the primary or secondary systems at SONGS.

V. The Original MUD and Ecolochem's Provision of Demineralization Services to SONGS.

27. As part of the initial design and construction of Units 2 and 3, a Make- Up Water Demineralizer (the "MUD" or the "original MUD") was built to remove mineral contaminants from water provided to SONGS by the Orange County Municipal Water District.

28. The original MUD included a mechanical device known as a vacuum degasifier, which was designed to remove carbon dioxide from the water, but which also had the effect of deoxygenating the water passing through it.

29. The original MUD was underdesigned, and could not produce the large volumes of water necessary during start-up.

30. Among other things, the original MUD was designed to produce only 400 gallons per minute of water, which was grossly inadequate for the considerable water needs of the plant during start-up.

31. The original MUD also had inadequate storage capacity to store the water that had to be kept available for the plant's needs.

32. Because of the inadequacies of the original MUD, in early 1983, Edison began efforts to design a permanent facility that would meet the make-up water demineralization needs of SONGS.

33. Edison also took steps to address its immediate demineralized water supply needs during the interim period while the design, bidding and construction of the permanent demineralization system went forward.

34. Edison initially utilized Arrowhead and Polymetrics, two outside water treatment equipment providers, to provide the large amounts of water necessary for start-up.

35. These companies had no capability to regenerate their demineralization units on-site, requiring the shuttling of trucks onto and off of Edison's premises to provide demineralized water.

36. The quality of water provided by these vendors was also relatively poor. The equipment would often be operated past the breakthrough point — the point at which the ion exchange resins no longer removed ionic impurities — re-

sulting in unacceptable levels of impurities entering the secondary system.

37. In August 1982, Edison began using Ecolochem to service its demineralization needs for make-up water.

38. Ecolochem had several advantages over Polymetrics and Arrowhead.

39. Ecolochem used a patented trailer, called a Mobile Flow, to transport its demineralizer units, and was therefore able to use demineralization units that could produce a much greater volume of demineralized water.

40. Ecolochem also had the capacity to regenerate its demineralization units on-site, which made Ecolochem's process much more efficient and eliminated the need to have a large number of trailers constantly going in and out of the plant property.

41. In addition, Ecolochem, unlike Arrowhead and Polymetrics, provided support personnel who operated and monitored their equipment and who could both anticipate problems and solve them as they arose.

42. The purity of the water provided by Ecolochem through the Mobile Flow trailer was also much higher than Edison had received from the other vendors.

43. After an initial 90-day test period, from August to November 1982, Edison contracted with Ecolochem to provide supplemental make-up water through the Spring of 1983, and increased the amount of water to be provided by Ecolochem to account for increased water needs during start-up activities.

44. When Ecolochem first came on-site at SONGS, Edison requested only that the water Ecolochem supplied be demineralized, not deoxygenated.

45. Ecolochem initially won SONGS' supplemental water treatment services contract for reasons unrelated to its deoxygenation capabilities.

VI. The Lack of Industry Standards on Dissolved Oxygen Levels in Make-Up Water Prior to 1982.

46. The dissolved oxygen concentration of make-up water entering SONGS varies between approximately 6 and 10 or 11 parts per million (ppm).

47. The original MUD incidentally removed oxygen from the make-up water it treated. It was not, however, Edison's practice prior to 1982 to make a conscious effort to deoxygenate make-up water in any of its power plants.

48. Edison did not make a conscious effort to deoxygenate its make-up water prior to 1982 because it relied on industry and equipment manufacturer specifications, as well as its own experience, in devising the water chemistry requirements for its power plants.

49. One such set of specifications was authored by Combustion Engineering ("CE"), the manufacturer of the steam generators used by Edison at SONGS. CE provided Edison and its other generator customers with recommended specifications of maximum levels of various impurities in the water fed to the generator through the secondary cycle.

50. These specifications typically placed rigorous limits on the amount of silica, chlorides, fluorides, sodium, sulfate, and other impurities that could be tolerated in the power cycle. Prior to 1982, however, they did not include any specification for limits on dissolved oxygen in make-up water.

51. While dissolved oxygen had been known to be a potential contributor to corrosion in boilers and generators for many years prior to 1982, the focus of industry and equipment manufacturer specifications had been on the

overall concentration of oxygen in the condensate and feedwater fed to the generator during power operation, not on the dissolved oxygen concentration in make-up water.

52. The lack of industry standards on the level of dissolved oxygen in make- up water reflected the fact that, whatever level of dissolved oxygen was present in make-up water when it entered the primary or secondary system, it was quickly deoxygenated upon entering those systems during power operation, and thus did not significantly increase the oxygen levels of the primary coolant or the secondary feedwater or condensate.

53. For example, in the primary system, any oxygen introduced from the make- up system during power operation would react with hydrogen present in the system. In the high-temperature and high radiation field environment of the primary cycle, hydrogen reacts very quickly with any oxygen entering the system to create water.

54. Moreover, make-up water constituted an extremely small percentage of the total feedwater. As a result, even aside from the deoxygenation of the water once it entered the system, dissolved oxygen introduced into the primary system by make-up water had only a very small and non-detectable effect on the dissolved oxygen concentration of the water as a whole.

55. On the secondary side, make-up water was also quickly deoxygenated when the plant was at full power. For example, make-up water at SONGS was sprayed into the steam phase of the condenser, which resulted in effective deoxygenation of the water.

56. In addition, hydrazine was added to the water circulated through the secondary system during normal high-temperature operations, which limited dissolved oxygen levels because hydrazine reacts with oxygen at high temperatures to form water and nitrogen gas.

VII. The Increase in Industry Concern about Dissolved Oxygen in the Early 1980's.

57. In the 1970's and early 1980's, the power generating industry became increasingly concerned with the role dissolved oxygen played in corrosion and the need to control the level of dissolved oxygen at startup and restarts of PRWs.

58. During the Fall of 1982, two documents were published that reflected the need for utilities to undertake affirmative measures to deoxygenate water coming out of their make-up systems.

59. The first, by the Electric Power Research Institute ("EPRI"), a voluntary research organization of the industry, was titled "PWR Secondary Water Chemistry Guidelines" and was intended to provide a set of consistent chemistry standards for all PWR secondary systems.

60. The Guidelines established much higher water chemistry standards than had existed previously.

61. The Guidelines recommended that the industry adopt a specification for limits of dissolved oxygen in auxiliary feedwater in times of start-up of no more than 100 parts per billion (ppb).

62. Auxiliary feedwater is often provided from a plant's make- up demineralization system. Accordingly, plants needed to deoxygenate their make- up water to meet the new Guidelines.

63. Shortly after the EPRI Guidelines were issued, in October 1982, Combustion Engineering ("CE"), the manufacturer of the steam generators of Units 2 and 3 at SONGS, issued Revision 3 to its Chemistry Manual CENPD-28, which was the manual containing chemical specifications applicable to plants using CE steam generators.

64. In this 1982 revision, CE included, for the first time, a suggested limit of 100 ppb on the amount of dissolved oxygen present in water used for auxiliary feedwater.

65. Prior versions of the CE specifications had included rigorous limits on the amount of silica, fluoride, chloride, sodium, sulfate, and other impurities in water fed to the steam generators but had not included any limitation of dissolved oxygen coming out of the make-up system.

VIII. Edison's Request That Ecolochem Deoxygenate Its Make-Up Water.

66. As late as May 1983, the supplemental make-up water Edison had been using for start-up activities, whether provided by Ecolochem or other vendors, was not deoxygenated.

67. In response to the CE specifications and EPRI Guidelines, and out of its own concern to reduce the level of dissolved oxygen in the make up water, Edison personnel determined in 1982 that the make-up water at SONGS should be deoxygenated as well as demineralized.

68. Around the beginning of 1983, Edison asked Ecolochem representatives whether they could provide deoxygenation as well as demineralization of its make-up water.

69. Ecolochem proposed a chemical deoxygenation process it had available at that time known as the sulfite regeneration anion process ("SRAP"), which employed sodium sulfite as an oxygen scavenger.

70. This was not an optimal solution because if sodium sulfite got into the generator it could contribute to corrosion.

71. The sulfite process also involved difficulties in meeting dissolved oxygen specifications, had a finite capacity,

was very costly, required complicated waste procedures, and could not be regenerated on-site.

72. Ecolochem also mentioned the possibility of providing a vacuum degasifier to meet Edison's deoxygenation needs. Vacuum degasification (or deaeration) is a mechanical method by which oxygen is removed from water, and is a standard method by which fossil and nuclear power plants remove oxygen from water.

73. Ecolochem also had been developing a different chemical deoxygenation process during this time period. In April 1983, Ecolochem made an alternative proposal to meet Edison's deoxygenation needs with its new chemical process, which is the subject of the patent in suit.

IX. The Development of the Patented Process.

72. Two Ecolochem employees, Mr. Miller and Mr. Dickerson, invented Ecolochem's claimed deoxygenation process.

73. In 1981, Ecolochem hired William Miller to be its Technical Manager in charge of research and development. Mr. Miller received his Bachelor of Science degree in chemistry from LaSalle University in 1974. He also had attended several continuing education courses in chemical engineering and regularly attended and conducted various seminars on water purification. From 1964 to 1974, he was employed by Rohm and Haas Company, a chemical company involved in the manufacture of ion exchange resins. While at Rohm and Haas his duties involved the synthesis of ion exchange resins, the testing of ion exchange resins, and the application of ion exchange resins to water and wastewater treatment. From 1974 through 1979 Mr. Miller was employed by the Permutit Company, a manufacturer of water and wastewater treatment equipment. While employed by Permutit, he was in charge of the ion exchange applications laboratory.

74. Mr. Miller's co-inventor was Mr. Dickerson. Mr. Dickerson has been employed by Ecolochem since 1973. Prior to joining Ecolochem he worked for Servi-Soft where he gained experience with ion exchange, water softening, demineralization and filtration methods. At Ecolochem he is partly responsible for research and development. Mr. Dickerson has secured other patents including a mobile water purification apparatus, the MobileFlow (U.S. Patent No. 4,383,920), a mobile demineralizer (U.S. Patent No. 4,049,548), and a purification process for vinyl acetate (U.S. Patent No. 4,379,940).

75. In November 1982, Mr. Miller went to the International Water Conference, an annual symposium of those in the water treatment industry, hoping to learn about alternative methods of ambient temperature deoxygenation to the sulfite process.

76. At the conference, John Pugsley, an Ecolochem sales manager who previously had worked at Florida Power & Light, told Mr. Miller that someone at Florida Power & Light had an article that discussed deoxygenation involving activated carbon.

77. In November 1982, Mr. Miller received in the mail from someone at Florida Power & Light a copy of an article by F.R. Houghton and J.C. Cuerdon entitled, The Use of Active Carbon With Hydrazine in the Treatment of Boiler Feed Water (the "Houghton article"). The article had been presented at the 1957 International Water Conference at Bournemouth, England.

78. The Houghton article describes a method of deoxygenation whereby hydrazine is added to water containing dissolved oxygen, and the water then is passed through an activated carbon bed to catalyze the reaction between the hydrazine and the oxygen.

79. Houghton reported that, by this method, the reaction between hydrazine and oxygen, which occurs slowly at ambient temperatures, could be accelerated significantly.

80. Mr. Miller and Ecolochem Executive Vice President Richard Dickerson, discussed the Houghton article and decided that it was worth exploring further as a deoxygenation method.

81. In early 1983, Mr. Miller and Mr. Dickerson began performing experiments to determine if the results reported by Houghton could be obtained in a laboratory setting.

82. These experiments indicated that the use of an activated carbon column did catalyze the hydrazine/oxygen reaction, and led to low levels of oxygen downstream of the carbon bed. The dissolved oxygen levels were substantially the same as those reported in the Houghton reference.

83. The tests also revealed high levels of conductivity in the water coming out of the carbon bed. Conductivity is a measure of the electrical charge of water, and often reflects the presence of ions in water. Further analysis by Ecolochem technicians established the presence of ionic substances, which were consistent with the high levels of conductivity.

84. For years it had been known in the art of water treatment that activated carbon releases ionic substances into water. Prior to their experiments, however, neither Mr. Miller nor Mr. Dickerson had been aware of this fact.

85. Mr. Miller and Mr. Dickerson initially attributed the high conductivity levels of the water exiting the carbon bed to their addition of excess hydrazine to the water, over and above the amount necessary to react with the dissolved oxygen. Since hydrazine is a cationic substance, excess hydrazine would affect the conductivity levels of the water exiting the carbon bed.

86. Mr. Miller and Mr. Dickerson reduced the levels of hydrazine that they added to the water, but still noticed high conductivity levels.

87. They then recognized that the carbon bed might be leaching contaminants into the water. Mr. Miller had the water tested for the presence of ionic contaminants, such as sodium, chloride, and sulfite and confirmed that such contaminants were present in the water downstream of the carbon bed.

88. Ecolochem did not test for the presence of any substances other than ionic contaminants that may have caused the high conductivity measurements.

89. As of 1982, ionic contaminants in water typically were removed by ion exchange.

90. To remove the ionic contaminants coming off the carbon, Mr. Miller and Mr. Dickerson placed a mixed bed ion exchange resin downstream of the carbon bed.

91. The mixed bed Mr. Miller and Mr. Dickerson selected was in the hydrogen/hydroxide form, the standard form used in high-purity water applications.

92. It was Mr. Miller's expectation that ion exchange would solve the problem of conductivity if, as he expected, the conductivity had resulted from the ionic contaminants.

93. Mr. Miller and Mr. Dickerson did not try any other way to remove the ionic contaminants leached by the carbon bed other than adding the mixed bed.

94. As suggested by the prior art concerning the removal of carbon contaminants, the mixed bed was fully successful in removing these contaminants.

95. Mr. Miller's and Mr. Dickerson's experiments on their version of the Houghton process took several months. Much of that time was spent in determining the parameters

of the process under unusual conditions, such as when the hydrazine flow was interrupted, or the water flow varied significantly over time. At the time Ecolochem offered the process to Edison, however, Mr. Miller and Mr. Dickerson felt they had developed a process that would work for Edison.

96. Edison accepted Ecolochem's proposal to implement its new process as a temporary solution to the oxygen issue until Edison was able to construct its new permanent make-up demineralizer. Ecolochem began providing deoxygenation services for its demineralized water at SONGS in June 1983, and continued to provide such services until 1986, when Edison's permanent make-up demineralizer began operation.

97. At Ecolochem's request, Edison entered into a secrecy agreement providing that Edison would not divulge the nature of Ecolochem's process to third parties.

98. The Ecolochem trailers that had been demineralizing Edison's water up to that time had consisted of cation beds, followed by anion beds, followed by mixed beds.

99. In the new process, Ecolochem inserted a trailer in between the anion beds and the mixed beds. Thus, Ecolochem was able to leave the same mixed bed in place that it previously had been using to demineralize Edison's water.

100. At approximately this same time, Ecolochem began the preparation of a patent application which was filed in December 1983 and eventually resulted in the issuance of Patent No. 4,556,492 (the "492 patent") on December 5, 1985.

101. The '492 patent ultimately was issued after several rejections by the Patent Examiner on the grounds of obviousness in light of the prior art.

102. In July 1985, Ecolochem filed an application for a continuation patent to the '492 patent. Again, the application was rejected several times by the Patent Examiner.

103. The prosecution of the continuation patent then was suspended while Ecolochem tried an infringement suit against Memphis Mobile Water Technology Corporation in the Eastern District of Arkansas.

104. Ecolochem prevailed in the infringement suit. See Ecolochem v. Mobile Water Technology Co., 690 F.Supp. 778 (E.D.Ark.1988), aff'd, 915 F.2d 187 (Fed.Cir.1990), (district court refusing to find Ecolochem's patent obvious on the record before it).

105. Following this decision, Ecolochem resumed its application for a continuation patent, and the Patent Examiner granted the continuation patent, Patent No. 4,818,411 (the "411 patent"), on April 4, 1989.

106. The '411 patent in suit contains 21 claims.

107. Ecolochem contends that Edison infringes claims 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18 and 20.

108. Much of the relevant art that has been introduced before the Court in this case, including the Demmitt reference that Judge Gadbois found anticipated various claims of the '492 patent, was neither before the Patent Examiner nor the Arkansas District Court at the time of their decisions.

X. The Design and Construction of Edison's High-Flow Make-Up Demineralizer (the "HFMUD").

109. During the time period that Ecolochem was providing temporary demineralization services to Edison, Edison was proceeding with its plans to design and construct a permanent make-up demineralization system to replace the original MUD.

110. In the 1970's, Edison had designed demineralizers for a number of its fossil plants.

111. Edison Chemical Engineer David Auerswald, who acted as a consultant during the Start-up activities of Units 2 and 3, had designed many of these systems.

112. The common pattern for Edison's fossil plant demineralization systems in the 1970's was a four-bed system consisting of primary cation and anion exchange resins followed by secondary cation and anion exchanges.

113. Mr. Auerswald considered such a four-bed system superior to the most likely alternative, a three-bed system using cation, anion, and mixed bed resins, because of the problems that Edison had encountered in regenerating the mixed bed in the original MUD at SONGS, and based on his personal experience that four-bed systems generally outperformed mixed bed systems in producing pure water.

114. In setting the original water chemistry specifications for the HFMUD, Edison consulted the guidelines set forth in Revision 3 to the Combustion Engineering Chemistry Manual, the recent EPRI chemical guidelines, and Mr. Auerswald discussed those specifications with representatives of CE.

115. After soliciting input from CE personnel, Mr. Auerswald recommended that Edison install a vacuum deaerator to meet the CE oxygen limit of 100 ppb for auxiliary feedwater and employ a nitrogen blanketing system to maintain low oxygen levels in the demineralized water storage tank.

116. The original specification for the HFMUD was issued on March 13, 1984.

117. The original design, based largely on the demineralization system recently designed by Mr. Auerswald at Edison's Alamitos facility, called for a four-bed system

consisting of primary cation bed, primary anion bed, secondary cation bed, and secondary anion bed.

118. The design also called for a vacuum deaerator to be used to remove oxygen from the demineralized water and included a dissolved oxygen requirement of 50 ppb, to be achieved by use of the deaerator.

XI. The Inclusion of A TOC Specification In the HFMUD.

119. In the early 1980's, the power generating industry became increasingly concerned about the control of another contaminant, Total Organic Carbon (TOC). TOC is an indication of the concentration of organic matter in a water source.

120. TOC refers to a broad category of organic materials.

121. One type of organic material, organic halogens, sometimes referred to as TOX, can be particularly detrimental when present in a steam generator, where they can break down into highly-corrosive acids called chlorides.

122. Because there was no accurate way to measure TOX in the early 1980's, the level of TOC was used as a broad indicator of the level of halogens that might be present in the water.

123. Aside from corrosion, high TOC levels also were a concern because they could cause premature replacement of ion exchange resin in "polishers" used elsewhere in the secondary cycle.

124. Around the same time that Edison was evaluating the design of its new HFMUD, Edison was in the process of installing $80 million worth of equipment called Full-Flow Condensate Polishing Demineralizers ("FFCPDs"). This system acted as a final purifier, or polisher, of the water after

it left the condensate storage tank and before it entered the feedwater cycle.

125. If significant levels of TOC passed through the make-up system into the condensate storage tank, they would have shortened the life of the anion exchange resins in the FFCPD, leading to significant capital expenditures.

126. The water used for make-up water at SONGS typically contained relatively large amounts of TOC, from about 1 to 5 ppm.

127. Demineralizers of the type on which the design of the HFMUD was based reduced TOC levels only to approximately 200-300 ppb.

128. Such a level of TOC in the water in the demineralizer would have caused loading problems for the anion exchange resins in the condensate polishing system.

129. Because Revision 3 to the CE Chemistry Manual did not include a TOC specification, the original specification for the HFMUD prepared by Project personnel did not include a TOC specification.

130. However, as a consequence of the foregoing concerns about TOC, SONGS Station personnel requested that a 50 ppb specification for TOC, and additional funding for such a system, be added to the HFMUD system.

131. Bidders for the HFMUD included Graver, Illinois Water Treatment, and L.A. Water Treatment Corporation.

132. While discussions about inclusion of a TOC specification were ongoing, bidders for the HFMUD were informed that TOC removal might be required in the new system.

133. L.A. Water and Illinois Water Treatment proposed ultrafiltration and activated carbon as possible methods for TOC removal, and L.A. Water also proposed a third

method, anion resins configured to remove organics. At the time, each of these methods was a well-known method of removing organics from water.

134. Edison rejected the initial proposals for reducing TOCs as too costly. Because Edison was aware of the low levels of TOC that Ecolochem was obtaining with its equipment, Edison asked Ecolochem for an estimate of the capital cost to replicate Ecolochem's system and learned it would cost about $100,000. Edison also sought to investigate "why Ecolochem's equipment can remove TOC to less than 10 ppb at 600 GPM with a device not designed for TOC removal." Exh. 553. At one point, Edison gave four prospective bidders a tour of the site for the HFMUD including a discussion of Ecolochem's equipment. On another occasion, Mr. Bascom, an Edison employee, admitted to Mr. Auerswald, that he shared information about Ecolochem's process with others in violation of the secrecy agreement.

135. L.A. Water, the successful bidder, ultimately proposed reducing TOC by placing an activated carbon bed between the primary ion exchange resins and the secondary ion exchange resins in the design of the HFMUD.

136. L.A. Water suggested that placement of the carbon bed in this position would allow any contaminants leached from the carbon bed to be removed by the ion exchange resins.

137. Edison expressed concern to L.A. Water about the frequency with which the activated carbon bed would need to be changed if activated carbon were the method of TOC removal.

138. In a joint agreement with Edison, L.A. Water subsequently performed tests on both activated carbon and ion exchange removal mechanisms, and examined methods of extending the useful life of the carbon bed. The tests were

performed at Edison's El Segundo plant in consultation with Edison chemical engineers. After completing the tests, L.A. Water provided Edison with copies of the test data and orally informed Edison of the test results.

139. Following completion of its tests, L.A. Water proposed to Edison that activated carbon would be an effective method for TOC removal at the HFMUD. L.A. Water also indicated that its tests had suggested that the addition of hydrazine to the activated carbon would prolong its ability to reduce TOC. As recognized by Edison in this litigation, however, the testing procedure employed by L.A Water was inadequate to conclusively determine that the addition of hydrazine would extend the life of the activated carbon bed. Moreover, the tests were inadequate to determine whether hydrazine has any effect on TOC reduction or dissolved oxygen. Nonetheless, Edison and L.A. Water proceeded with L.A. Water's proposed system, which effectively copied Ecolochem's deoxygenation process.

140. In October, 1984, Ecolochem notified L.A. Water of its concern that L.A. Water's proposed system would infringe its potential deoxygenation patent. L.A. Water passed on Ecolochem's potential patent infringement concerns to Edison. After several modifications in L.A. Water's initial proposal as reflected in Exhibits 406 and 462, L.A. Water's proposed system was accepted by Edison and construction of the High-Flow Make-Up Demineralizer ("HFMUD") began in 1985.

141. L.A. Water also supplied the vacuum deaerator for the HFMUD. The deaerator was a 54-foot high piece of equipment costing more than $330,000.

142. After learning that L.A. Water had been awarded the bid for the HFMUD shortly after the award was made, Ecolochem sought a possible service contract whereby

Ecolochem would, upon its completion, operate the HFMUD for Edison.

143. Ultimately, Edison senior management determined that Edison would prefer to staff its permanent facility with its own employees, and Ecolochem's proposal was rejected.

144. In 1986, Edison completed construction of and began to operate its High- Flow Make-Up Demineralizer.

XII. The HFMUD.

145. The HFMUD at SONGS provides make-up water to Units 2 and 3. The HFMUD has two trains of ion-exchange units, a vacuum deaerator, and storage tanks.

146. Each train contains four ion-exchange vessels serially attached for removal of ionic impurities with an activated carbon bed in the middle of the ion exchange trains for removal of TOC.

147. The first ion exchange vessel, the primary strong acid cation unit (PC), removes the bulk of all cations (typically sodium, calcium, magnesium and potassium), and replaces them with hydrogen ions.

148. The water next flows through the primary weak base anion unit (PA). The PA removes the dissolved anions present in the PC effluent (typically, chloride, sulfate and nitrate), replacing them with hydroxide ions. As Mr. Auerswald testified, the PA removes approximately 80% of the TOC from the municipal service water.

149. The water next enters the carbon filter (CF).

150. One purpose of the carbon filter is to remove TOC from the water. Another purpose is to aid in removal of dissolved oxygen.

151. As the water passes through the carbon bed, organic molecules become trapped in the pores of the carbon granules and are removed from the water.

152. Since there are a finite number of pores available to absorb the organics, the useful life of the carbon bed is limited.

153. Pursuant to L.A. Water's recommendation, Edison adds uncatalyzed hydrazine to the water in order to extend the expected life of the activated carbon. However, as noted above, there is no scientific data that would support this conclusion. The hydrazine, does aid in the removal of dissolved oxygen. The hydrazine and carbon typically remove 60 percent of the dissolved oxygen while removing 5-15 percent of the TOC.

154. Edison uses a thirty-five percent solution of hydrazine.

155. The hydrazine is added to the water upstream of the carbon bed by means of a pump. The activated carbon catalyzes a reaction between the dissolved oxygen and hydrazine in the incoming water. The maximum flowrate of the pump is 0.923 gallons per hour. At the typical flowrate of 900 gpm for water entering the HFMUD, this results in a maximum hydrazine concentration of approximately 5.6 ppm.

156. This amount is less than the amount necessary to react with all of the dissolved oxygen (the "stoichiometric" amount). The level of dissolved oxygen present in the water after the reaction of the hydrazine and dissolved oxygen, but before the water enters the vacuum degasifier, is at times in the range of hundreds of parts per billion. Any unreacted hydrazine appears downstream of the activated carbon bed.

157. Testimony by Ecolochem's witnesses Collister and Miller suggesting that HGMUD had dissolved oxygen levels as low as 5 ppm with hydrazine added at 5.65 ppm was not

credible. All of the documentary evidence based on tests at HGMUD supports Edison's contention that it never added more than a stoichiometric amount of hydrazine to the water in the HFMUD.

158. After leaving the carbon filter, the water next enters the secondary cation (SC) unit.

159. The secondary cation resin is similar to the resin used in the PC and performs the same function.

160. The concentration of cations left in the water after the PC is very low and the SC acts as a polisher, further reducing the final concentrations of cations to even lower levels. The SC resin will also remove any unreacted hydrazine.

161. The resulting demineralized water is piped to the vacuum deaerator where remaining dissolved oxygen is removed to bring the level of oxygen below 50 ppb. The patented process has a beneficial effect on the final dissolved oxygen level of the water exiting the HFMUD.

162. The vacuum deaerator consists of a vertical pressure/vacuum vessel containing plastic packing media.

163. Water enters the top of the deaerator and is sprayed downward over the packing.

164. At the same time, vacuum pumps are used to draw the oxygen (and other gases) out of the water.

165. The deaerated water falls into a storage section, still under vacuum.

166. The deaerated water is pumped into storage tanks and placed under nitrogen blankets to maintain an oxygen free environment.

167. Given the below-stoichiometric levels of hydrazine added to the water at SONGS, the dissolved oxygen content would not meet the suggested industry limit of 100 ppb, let

alone Edison's own specification of 50 ppb, if the vacuum deaerator were not used.

168. The deaerator has never been bypassed during service, nor has water ever been routed from the HFMUD to the demineralized water storage tanks at SONGS while the deaerator was out of service.

169. Edison has never made any adjustment to the hydrazine flow upstream of the deaerator to address the issue of deaerator performance. Nonetheless, the Ecolochem process and the vacuum deaerator are complimentary and provide optimum capability and flexibility for oxygen control

170. Edison has never attempted to meet its dissolved oxygen levels by adding at least a stoichiometric amount of hydrazine to the water upstream of the carbon filter. In 1993, Ecolochem tested the water passing through the HFMUD for levels of hydrazine before and after the bed of activated carbon. These tests detected a measurable amount of hydrazine before and after the activated carbon.

171. The secondary strong acid cation exchange resin and secondary strong base anion exchange resins act as a filter and remove undissolved carbon contaminants added by the activated carbon.

172. Edison backwashes the activated carbon with demineralized water before contacting the carbon with the water and hydrazine mixture.

173. The temperature of the water treated by the HFMUD is above the freezing point of water and below the temperature at which the cation and anion exchange resins would be damaged.

174. Edison adds an amount of hydrazine, a corrosion inhibiting substance, to the water it circulates through the secondary sides of Units 2 and 3.

XIII. The Time Period Prior To Ecolochem's Filing Suit.

175. Ecolochem learned of the proposed design of the new HFMUD system well before construction was completed. On or about the beginning of 1986, Ecolochem representatives began to inform Edison of their belief that Edison's new system infringed upon the chemical deoxygenation process for which Ecolochem had recently obtained a patent. On May 19, 1986, Ecolochem provided Edison with a copy of the '492 patent and a proposed license agreement for the '492 patent.

176. In response, Edison representatives without seeking a formal written legal opinion, informed Ecolochem that they did not believe the HFMUD infringed on their process, because the use of hydrazine and activated carbon in the Edison system was for the purpose of organics removal, not deoxygenation, and because deoxygenation in Edison's system was accomplished by mechanical means, namely the vacuum deaerator.

177. From 1986 until 1992, while Ecolochem frequently raised the issue of Edison's alleged infringement of its process informally, Ecolochem refrained from bringing suit against Edison. Although Ecolochem did not file suit against Edison, in December 1985 it filed a patent infringement action against Mobile Water in the Eastern District of Arkansas. And in September 1986, Arrowhead Industrial Water filed a declaratory judgment action against Ecolochem in the Northern District of Illinois. On April 26, 1990, Ecolochem's counsel informed Edison of these two other lawsuits, and that it would seek redress from any other alleged infringers, including Edison, upon resolution of these two lawsuits.

178. During this time period, Ecolochem sought to maintain and develop its business relationship with Edison.

179. As noted above, at the same time that Ecolochem was accusing Edison of infringing its patent in the design of the HFMUD, Ecolochem was also seeking a services contract with Edison allowing it to operate the new HFMUD for Edison.

180. Ecolochem also solicited and received the contract to provide supplemental or emergency water services for SONGS in the event the HFMUD was inadequate.

181. On numerous occasions in the late 1980's and early 1990's, Ecolochem also attempted to obtain a contract to provide a reverse osmosis treatment system at SONGS, and to provide other water treatment services to Edison's other facilities.

182. In 1992, Ecolochem lost out on a bid to provide supplemental demineralized water services to Edison. Shortly thereafter, in June 1992, Ecolochem filed the present lawsuit against Edison.

183. Edison has not suffered any prejudice or any economic harm as a direct result of Ecolochem's delay in filing suit. Even before Ecolochem could have filed a patent infringement action, Edison had designed the HFMUD to include Ecolochem's deoxygenation process.

XIV. The Edison Legal Opinion.

184. On May 8, 1989, Clifton McCann of Lane & Aitken sent a letter to Robert C. Weiss of Lyon & Lyon, who had served as outside counsel to Edison. Mr. McCann's letter expressed the belief that Edison had practiced a process infringing to Ecolochem's '492 patent.

185. Following receipt of the letter, Edison, after operating the HFMUD for approximately three years, decided to obtain a letter from Mr. Weiss's firm expressing an opinion as to whether Edison's HFMUD infringed either Ecolochem's '492 patent, or its recently issued '411 patent.

Despite the concerns expressed by Ecolochem during the design and construction phases that the HFMUD infringed its deoxygenation process, this was the first time that Edison sought a formal legal opinion regarding its alleged infringement of the '492 patent.

186. Mr. Weiss issued his formal opinion to Edison on May 9, 1990.

187. This opinion, which was based upon information provided by Edison, expressed the view that the process practiced by Edison at its HFMUD did not infringe Ecolochem's patent.

188. The opinion indicates that the invention is based upon the Houghton process, which was known prior to Ecolochem's invention, and that Ecolochem's claim of novelty depended upon the addition of an ion exchange step to remove contaminants coming off the carbon bed used in the Houghton process.

189. The opinion also concluded that the specification of the patent indicated that, in order to practice the invention, it was necessary to use enough hydrazine to react with the dissolved oxygen completely. In this regard, the opinion alluded to statements in the specification that it was "necessary" to use enough hydrazine completely to react with the dissolved oxygen, i.e., an extra-stoichiometric amount, to practice the invention.

190. The opinion concluded that Edison did not literally infringe Ecolochem's patent because Edison did not use such an extra-stoichiometric amount of hydrazine.

191. The opinion further concluded that Edison did not infringe the Ecolochem patents under the doctrine of equivalents because Edison's process did not perform substantially the same function, namely deoxygenation, in substantially the same way to obtain substantially the same result as Ecolochem's patented process.

192. Instead, the opinion concluded that the use of hydrazine and carbon in Edison's process served an entirely different function, the removal of TOC, than the use of hydrazine and carbon in Ecolochem's deoxygenation process. Deoxygenation in Edison's process, the letter concluded, was the result of the functioning of the vacuum deaerator. This part of Mr. Weiss' opinion is based upon Edison's stated intentions for using hydrazine and activated carbon to remove TOCs and to extend the life of the carbon bed and not on scientific data.

193. Although Edison sought a legal opinion regarding its alleged infringement of Ecolochem's patented process, it did not have a good faith belief that it did not infringe the patented process either before or after it obtained Mr. Weiss' opinion.

XV. The Patent In Suit.

194. The '411 patent describes a chemical deoxygenation process in which hydrazine is added to water passed through an activated carbon bed to catalyze a reaction between the hydrazine and the oxygen, and the water is then passed through ion exchange resins to remove excess hydrazine and dissolved contaminants given off by the carbon bed.

XVI. Facts Relevant To The Obviousness Determination.

A. Level of Ordinary Skill in the Art.

195. The art pertinent to the patent in suit is the art of water treatment, particularly the art of water treatment for high-purity water applications.

196. This art is highly sophisticated.

197. Persons of ordinary skill in this art were found in electric utilities, consulting firms, and water treatment chemical and equipment suppliers.

198. These persons commonly have at least an engineering or chemical engineering degree.

199. As noted above, William Miller, one of the inventors of the patents in suit, possesses a Bachelor's of Science degree in chemistry, and has attended several continuing education courses in the areas of chemical engineering, as well as numerous seminars on water purification.

200. Mr. Miller has published numerous papers on the subject of ion exchange.

201. Richard Dickerson, the other named inventor, had been involved in water treatment for more than 20 years at the time of the invention.

202. Ecolochem's expert, Herschel Klein, described the person of ordinary skill in the art of high-purity water as likely to be trained in chemistry or chemical engineering, and often to possess a chemical engineering degree.

203. At Edison's facilities in the early 1980's, several individuals were assigned the task of addressing water chemistry.

204. SONGS had a number of individuals located on-site with responsibilities for water chemistry concerns in the plant.

205. For Edison's other plants, water treatment issues typically were referred to the Central Chemical Group, which had approximately seven staff engineers and chemists capable of addressing water chemistry problems.

206. Both at SONGS and in the Central Chemical Group, those responsible for addressing water quality issues would typically have a degree in chemistry or chemical engineering, and would attend industry seminars to receive specialized training in the field and keep abreast of ongoing developments in the art.

207. Several of these persons had advanced degrees and/or ten or more years of experience within the industry, and had published technical papers within the water treatment industry.

208. Edison expert Irving Abrams testified that those involved in the water treatment industry with whom he was familiar typically have been involved in the industry for ten years or more, have at least a bachelor's degree in chemistry or chemical engineering, regularly attend conferences at which developments in the field are discussed, and are reasonably familiar with the principles of water purification, including ion exchange and activated carbon.

209. Those of ordinary skill in the art had extensive experience, kept abreast of developments in the field, and often regularly attended conferences at which water treatment issues were discussed.

210. The level of ordinary skill in the pertinent art was high. A person of ordinary skill in the art of water treatment in 1982 would have had at least a college degree in chemistry or chemical engineering, would have regularly attended seminars and conferences at which developments in the field of water treatment would have been discussed, and would have been employed in the area of water treatment for ten or more years.

B. The Difference Between The Patented Process and The Prior Art.

211. The broadest claim of the '411 patent is claim 20, which can be broken down into two essential components: (1) passage of liquid containing dissolved oxygen and hydrazine over a bed of activated carbon to catalyze a reaction between the oxygen and hydrazine; and (2) passage of the liquid through strong acid cation and strong base anion exchange resins to remove dissolved contaminants released into the water by the carbon bed.

212. Each of these components is disclosed in the prior art.

213. The first step of passing water through a bed of activated carbon to catalyze a hydrazine-oxygen reaction was known in the art of water treatment prior to Ecolochem's patent application.

214. The industry's knowledge of this step is acknowledged in the file wrapper for the '492 patent, which refers to both the Bechtel reference and to the Houghton article.

215. The Houghton reference, though publiclyavailable, was not well known prior to 1982.

216. The second step of claim 20, the removal of dissolved ionic contaminants given off by the carbon bed by ion exchange, was known in the art prior to the filing of the '492 patent.

217. Many in the art knew as of 1982 that carbon beds leached contaminants which could be removed by ion exchange.

218. Ion exchange was the most common way to remove ionic contaminants in the 1970's and early 1980's.

219. The knowledge in the art that activated carbon leaches dissolved contaminants is illustrated by the following publications: a December 1981 article by Dr. Friedrich Martinola article entitled "Saving Energy by Catalytic Reduction of Oxygen in Feedwater" and Hegde, Patent No. 4,430,226.

220. Removal of dissolved carbon contaminants by ion exchange is plainly disclosed in at least two publications: Hassler, Purification with Activated Carbon (1974), and the Hegde patent.

221. Moreover, by 1982, it was clearly recognized by experienced personnel in the power generating industry that

the final process that should be used to purify makeup water for use in nuclear and high pressure fossil power generating stations was demineralization employing a strong acid cation resin followed by or mixed with a strong base anion resin.

222. There is no evidence that any system for production of ultra-pure water ever included a carbon bed as the final step in water treatment; the evidence instead shows that a subsequent treatment mechanism (such as ion exchange) was always used to further purify water following the carbon bed.

223. Literature available at the time of Ecolochem's invention stated why carbon beds needed to be followed by ion exchange in any high-purity application — activated carbon leaches dissolved contaminants into water which must be removed to achieve high purity.

224. The two independent claims other than claim 20 asserted by Ecolochem are claims 1 and 15.

225. Both claims 1 and 15 differ from claim 20 in contemplating that the final ion exchange step will remove not only dissolved carbon contaminants, but also any excess hydrazine that has not reacted with the dissolved oxygen in the water.

226. Claim 15 (and claim 3 that depends from claim 1) also contemplate the release of undissolved carbon contaminants by the carbon bed, and call for the removal of such undissolved contaminants by passing the liquid through a filter downstream of the ion exchange step.

227. Claim 15 also specifies that: (1) the liquid involved is water; (2) the temperature of the water falls within the range between freezing and the temperature at which the water would damage the ion exchange resins; and (3) the water, following the deoxygenation process, is circulated through a power generating apparatus.

228. Claims 7, 8 and 9 depend from claim 1 and each claim adds one of the three limitations mentioned in the preceding paragraph to claim 1.

229. Each of the additional steps of claims 1 and 15 is disclosed in the prior art.

230. Earlier descriptions of an activated carbon-catalyzed hydrazine-oxygen reaction, such as Houghton, contemplated the use of an extra-stoichiometric amount of hydrazine, resulting in at least some unreacted hydrazine downstream of the activated carbon bed.

231. The presence of unreacted hydrazine reflects the fact that if all of the hydrazine added does not react, which necessarily occurs when an extra-stoichiometric amount of hydrazine is used, then there will be unreacted hydrazine remaining in the water.

232. Like the removal of carbon contaminants, the removal of hydrazine by use of cation exchange was also disclosed in the prior art, including Bechtel and Demmitt.

233. The other additional elements of claim 15 (and claims 3, 7, 8, and 9, which depend from claim 1) were also well-known in the art.

234. As mentioned above, claim 15 adds an element of removing any undissolved carbon contaminants through the use of filters downstream of the ion exchange step. (Claim 3, which depends from claim 1, also adds this element).

235. Prior to December 1982, it was well known in the art of water treatment that activated carbon beds give off undissolved contaminants.

236. It also was well known prior to December 1982 that undissolved contaminants given off by activated carbon could be removed by using filters.

237. The additional requirements that the liquid used in the process be water, that such liquid be at a temperature between freezing and a temperature at which the ion exchange resins would be harmed, and that the water be circulated through a power generating apparatus following the process (which are part of claim 15 and also are added to claim 1 through dependent claims 7, 8, and 9, respectively), were also disclosed in the art.

238. A principal application of any chemical deoxygenation process is to deoxygenate water to be circulated through a power generating apparatus.

239. Power generating facilities are among the principal users of deoxygenated water, and the concept of circulating deoxygenated water through a power generating apparatus was well-known in the art of water treatment long before December 1982.

240. In addition, water cannot be circulated when it is frozen (and is in the form of ice), nor would any operator circulate water through the process described in the '411 patent at a temperature so high as to damage the ion exchange resins used in the process.

241. Claim 4 depends from claim 1, differing from that claim only in contemplating that the activated carbon bed employed in the process described in claim 1 adds undissolved contaminants to the liquid that then are removed by the ion exchange resins (as contrasted, for example, to removal by filters)

242. As noted above, activated carbon is known to leach both dissolved and undissolved contaminants, and it also is known that ion exchange resins will remove, or trap, some undissolved contaminants.

243. Claim 5 depends from claim 1 and adds an element of backwashing the activated carbon bed prior to the first

step of the deoxygenation process to remove some of the carbon contaminants.

244. Claim 6 depends from claim 5 and specifies that the backwashing be done with demineralized water.

245. As noted earlier, it is well-known that carbon beds leach carbon contaminants. Because this is known, backwashing an activated carbon bed with demineralized water for the purpose of minimizing the amount of carbon contaminants given off by the carbon bed during operation is a common procedure in the field of water treatment.

246. Claim 10, which depends from claim 1, adds the requirement that the hydrazine used be uncatalyzed hydrazine.

247. Nearly all hydrazine manufactured commercially for use in deoxygenation processes in thermal power plants is uncatalyzed, and it would have been obvious to one of ordinary skill in the art to use uncatalyzed hydrazine for Ecolochem's process.

248. Claims 11 and 17, which depend from claims 1 and 15, respectively, add the requirement that the hydrazine used in the process be added to the liquid prior to its being passed over the carbon bed.

249. The various processes of catalyzing the hydrazine-oxygen reaction through use of an activated carbon bed, such as Houghton, contemplate that the hydrazine is added to the liquid prior to its passing over the carbon bed.

250. Claims 12 and 18 depend from claims 11 and 17, respectively, and add the step of the water passing though a two-step demineralizer before the hydrazine is added to the liquid.

251. A two-step demineralizer is a common preliminary step in water purification processes for high-pressure steam generators. For example, this step is discussed in the Marti-

nola article. It also would have been obvious to one of ordinary skill in the art.

252. Claim 13 depends from claim 1 and adds the step of a corrosion-inhibiting substance being added to the liquid after the deoxygenation process is completed.

253. This step is a routine procedure used in an application, such as that of a power generating apparatus, where liquid is being introduced into an environment that cannot tolerate high levels of corrosion. It also would have been obvious to one of ordinary skill in the art.

C. Secondary Considerations.

i. Long-Felt Need.

254. The primary use of Ecolochem's deoxygenation process has been for high-purity water treatment applications, such as power plants.

255. Ecolochem contends that its deoxygenation process met a long-felt need in the power plant industry for a better deoxygenation method at ambient temperatures.

256. The power generation industry consists principally of plants powered by fossil fuels and plants powered by nuclear energy. The nuclear plants consist of two types, boiling water reactors ("BWRs") and pressurized water reactors ("PWRs"). Ecolochem's claim of need must be addressed separately as to each type.

257. As of 1982, the fossil industry had not developed any specifications with regard to the dissolved oxygen concentrations of ambient temperature water.

258. Moreover, deoxygenation of fossil plants has been readily achieved since the 1960's by recirculating water to the plant's condenser, where it is deaerated before being routed to the boiler.

259. Accordingly, there was no long-felt need for ambient temperature deoxygenation as of 1982 in the fossil industry. This conclusion is supported by Ecolochem's lack of success in selling its process in the fossil industry.

260. There is also no evidence of a long-felt need for ambient temperature deoxygenation in BWRs. Whereas PWRs reduce oxygen to extremely low levels, BWRs require dissolved oxygen to be present in their systems for proper operations. Not surprisingly, therefore, there are no industry guidelines limiting the oxygen levels in BWR make-up system water.

261. Again, the absence of a need for ambient temperature deoxygenation in the BWR industry is further supported by Ecolochem's lack of sales in that industry.

262. In PWRs, as of 1982, specifications had long existed for the overall dissolved oxygen levels of the feedwater to which make-up water was added during high-temperature power operations. These specifications typically were met by adding hydrazine to the condensate and by adding ambient temperature make-up water at a point in the system (the condenser) where it was effectively vacuum deoxygenated.

263. Prior to 1982, however, there were no specifications for oxygen levels for ambient temperature water.

264. There has never been a need to deoxygenate ambient temperature make-up water when it is used for its principal application — to make up for the small losses in the primary or secondary systems of a PWR. These small amounts of water are immediately diluted within the water to which they are added and deaerated during high-temperature operation.

265. In the 1970's the PWR industry began to recognize the need to deoxygenate ambient temperature water during plant start-up. This need was recognized in the early 1980's, by the adoption of the EPRI Guidelines and manufacturer

specifications, like the CE Chemistry Manual, which called for oxygen limits in auxiliary feedwater, supplied from a plant's make-up demineralizer system.

266. As of 1982, deoxygenation of ambient temperature water could be accomplished through the use of technology already in existence, most notably use of a mechanical device known as a vacuum deaerator.

267. Ambient temperature deoxygenation also could be accomplished by one or more of the following approaches: (1) establishing a vacuum condition in the condenser early during the startup and deoxygenating the make-up water by adding it to the steam phase of the condenser; (ii) adding hydrazine to the condensate storage tank prior to startup; (iii) adding hydrazine directly to the auxiliary feedwater; and/or (iv) adding a nitrogen bubbling or sparging system to the demineralized water storage tank ("DWST") or condensate storage tank ("CST") where make-up water is stored to remove dissolved oxygen.

268. Based on the foregoing, prior to 1982, there was no unsolved long-felt need in the water treatment industry for an ambient temperature deoxygenation process.

ii. Commercial Success

269. During the years following its invention, close to 90% of Ecolochem's revenues came from fossil plants, nuclear plants, or chemical refineries.

270. When Ecolochem introduced its patented deoxygenation process into the marketplace, it experienced a significant increase in revenues in comparison to its prior sulfite deoxygenation process. In the first full year of sales of the new process Ecolochem generated over $2,000,000 in revenues. The process continued to generate approximately $2,000,000 annually. From 1983 to 1990 sales of the patented invention generated over 13 million dollars in revenue

while the SRAP process only generated approximately 1.5 million. By August 29, 1986 Ecolochem had sold and performed its patented deoxygenation process in at least 16 locations. By February 3, 1988 the process had been performed at approximately 28 plant locations.

271. However, as of 1986, three years after the process was introduced, Ecolochem had not made many sales to fossil plants, and Ecolochem was concerned that the fossil industry did not have a need for Ecolochem's process.

272. The process was also not a big seller with chemical refineries, other than for an occasional short-term job.

273. Ecolochem has achieved almost all of its commercial success in the PWR industry.

274. Ecolochem, however, has had limited success in licensing its deoxygenation process to PWRs.

275. Ecolochem was willing to license its deoxygenation process to any interested customer, which would have saved customers considerable amounts over the long-term costs of paying Ecolochem's service charges.

276. In 1986 Ecolochem made a concerted effort to license its patented deoxygenation process

277. Nevertheless, although Ecolochem subsequently offered its process to approximately 25-50 customers, only two purchased licenses, each for a very brief period of time. One of these, Florida Power & Light never used the Ecolochem process to deoxygenate any water. It instead relied on its vacuum degasifier.

278. In the late 1980's and early 1990's, Ecolochem was sufficiently concerned about the sluggishness of its deoxygenation sales to PWRs that it suggested a marketing strategy to increase its deoxygenation sales.

279. As Ecolochem's failed licensing efforts reflect, Ecolochem had difficulty selling its process to PWRs for long-term applications. Most of its sales of its deoxygenation services resulted from its ability to provide mobile emergency or temporary water treatment services while plants repaired or constructed their own deoxygenation systems using methods other than the patented process.

280. Consistent with its efforts to serve this "mobile" deoxygenation market, Ecolochem's promotional materials promoted its ability to provide immediate response to the supplemental water treatment needs of its customers when a plant's on-site water treatment facility failed, was out of service, experienced abrupt changes in water composition, or could not cope with unusual water demands. Ecolochem's ability to provide the patented process provided it an advantage in the mobile demineralizer market.

281. Approximately two-thirds of Ecolochem's deoxygenation revenues were attributable to emergency, short-term services, and fewer than 10% of Ecolochem's deoxygenation jobs from 1983-1990 were more than one-year contracts.

282. Of the more than 500 customers Ecolochem served in the mid-1980's time period, only 3 used the deoxygenation process to meet their permanent deoxygenation needs.

283. Factors other than the technical quality of its invention also contributed to Ecolochem's increased sales between 1983 and 1990.

284. As noted above, around the time of Ecolochem's invention, the EPRI Guidelines and revised CE specifications recommended that plants control the oxygen levels of water coming out of their make-up demineralizer systems. Many plants looked to mobile water treatment providers to obtain such deoxygenation until permanent deaeration equipment could be built.

285. At the time, in terms of mobile deoxygenation processes, there was essentially the unsatisfactory sulfite regeneration process and not much else. Other mobile systems, such as the palladium-based Catalytic Oxygen Reduction System ("CORS") and the DEHA process, did not reach the market until years later.

286. Ecolochem, by contrast, was utilizing its proprietary mobile apparatus to provide effective mobile deoxygenation treatment services as early as June 1983 and thereby acquired a significant marketing head start over the competition.

287. Ecolochem's patented technology for providing water treatment services gave it an additional advantage over its competitors in providing mobile water treatment services.

288. Ecolochem's patented "Mobile Flow" trailer was the apparatus of choice for all of Ecolochem's large jobs, including its deoxygenation jobs.

289. A sampling of customers of Ecolochem's deoxygenation services from 1982 through 1988 reflects that 11 of 14 deoxygenation customers received those services through Mobile Flow trailers, 2 used both Mobile Flow and Ecolochem's smaller Multi-Flow apparatus, and only one did not use Mobile Flow at all. More than 90 percent of the total gallonage of water deoxygenated for this group of customers was deoxygenated in Mobile Flow trailers.

290. Richard Dickerson described the Mobile Flow as "the best piece of equipment on the road," capable of producing water of higher quality than Ecolochem's competitors.

291. The Mobile Flow also had the capability to perform on-site regeneration, another considerable advantage over the equipment of Ecolochem's competitors.

292. The technical superiority of the Mobile Flow apparatus was one of the major selling points when Ecolochem promoted its services to its customers in promotional materials and in sales discussions. In one advertisement, Ecolochem described the Mobile Flow as "the world's largest and most advanced water plan on wheels." Ecolochem also asserted that it operated "the newest, most technically advanced fleet of mobile water treatment systems anywhere."

293. Other factors having nothing to do with Ecolochem's patented process also contributed to its sales in the PWR field. First, around the time Ecolochem began to market its new process, many PWRs had begun to move away from their historical pattern of performing water treatment in-house, and instead began to outsource their water treatment requirements to outside vendors.

294. Second, a major effect of the 1982 EPRI Guidelines was to increase significantly the importance of increasing steam generator "blowdown" rates.

295. Blowdown is the removal of water from the steam generators as a means of removing impurities.

296. By tightening the specifications with regard to impurities such as silica, sodium, fluoride, and chloride in the steam generator, the Guidelines led plants to increase the rate at which they removed water from their steam generators by blowdown.

297. Since blowdown results in a loss of water from the secondary cycle, the need for make-up water increased as blowdown flowrates increased.

298. In many cases, the need for higher blowdown flow rates during normal operation and startups, coupled with more stringent water quality goals, could not be supported by existing plant make-up water treatment systems, which often had inadequate capacity.

299. Ecolochem, as a mobile vendor, was able to meet the needs of utilities for increased volumes of demineralized and deoxygenated water on a timely basis without extensive capital investment.

300. In sum, the evidence established that a number of factors unrelated to the technical quality of Ecolochem's invention were major contributors to its limited success in the PWR market: the industry-wide recognized need in the early 1980s for PWRs to deoxygenate ambient temperature water; the ability of Ecolochem to provide its deoxygenation process on a mobile platform to meet this need until other methods could be devised; the shift in the industry towards increased reliance on outside vendors for water treatment services; and the overall expansion of Ecolochem's business.

iii. Failure By Others.

301. Ecolochem contends that references by Dr. Abrams and Bechtel, as well as the experiences of Edison, Arrowhead, and others indicate a failure by others to come up with the claimed invention, and that these failed attempts indicate that their invention was not obvious.

302. Nothing suggests that the Bechtel Group was seeking to find an improved method of ambient temperature deoxygenation or that Bechtel failed to solve the supposed problem of the Houghton process. To the contrary, the Bechtel reference indicates that effective deaeration equipment was available and in use as of 1982.

303. Moreover, anyone of ordinary skill in the art reading Bechtel would have known that the carbon contaminants mentioned could be removed by ion exchange.

304. Dr. Abrams' work also does not reflect a failure to come up with Ecolochem's invention. Dr. Abrams did not even attempt to improve the Houghton process. Instead, his work involved an ion exchange deoxygenation process,

which he ultimately abandoned due to a lack of interest in chemical deoxygenation at the time.

305. Evidence relating to Edison's efforts to deoxygenate the water from its temporary make-up demineralizer in 1983 also does not suggest failure to invent an ambient temperature deoxygenation process. Instead of attempting to come up with a deoxygenation method on its own, Edison simply left it to Ecolochem and other vendors to propose methods of deoxygenation.

306. Arrowhead similarly did not fail to make the invention. The evidence reflects that it was simply unaware of the Houghton reference, and thus did not know that hydrazine could be used to deoxygenate water at ambient temperatures.

307. Accordingly, the evidence does not suggest that others tried but failed to make Ecolochem's invention.

iv. Simultaneous Invention.

308. In February 1983, prior to issuance of Ecolochem's patent, Todd Hook of NWT, a consulting firm in the nuclear power industry, conducted an experiment regarding the Houghton process.

309. Mr. Hook tested the Houghton process using different types and sizes of activated carbon.

310. In addition to confirming Houghton's findings, his goals included assessing the effectiveness of the Houghton process at varying hydrazine-oxygen ratios, and determining the oxygen removal efficiencies of using different types of carbon to catalyze the hydrazine-oxygen reaction.

311. Like Ecolochem, the Hook experiments included use of a mixed bed resin downstream of the carbon bed.

312. A mixed bed was included as the final step in the process because the test was set up as a closed loop system.

That is, the water exiting the end of the test apparatus was re-routed to the beginning, air was re-introduced into the water, and the water was then circulated again through the system.

313. The NWT personnel knew that the activated carbon used in the process would give off contaminants, and that some of the hydrazine being added to the system for deoxygenation purposes would remain in the water coming off of the carbon bed.

314. Accordingly, the mixed bed was inserted into the test apparatus to remove both excess hydrazine and carbon contaminants, such as sodium, chloride, and silica, from the water.

315. The experiment showed that with as little as a stoichiometric amount of hydrazine, significant removal of dissolved oxygen, on the order of 99 percent, could be achieved.

316. By the end of the experiment, Mr. Hook was confident that an excess of 5 percent over the stoichiometric amount would have been a sufficient amount of hydrazine to remove dissolved oxygen.

317. The results of the experiment indicated that the process NWT tested was sufficiently successful at removing oxygen to have been useful for deoxygenation of makeup water in the power plant industry.

318. NWT did not consider its improvement on the Houghton process to be sufficiently novel to be patentable, and did not pursue a patent on its experiments.

v. Teaching Away.

319. There is no evidence that the prior art "taught away" from Ecolochem's invention by suggesting that the Houghton process was unusable or ineffective.

320. The references that mentioned the Houghton process, including Bechtel and Martinola, described it as a feasible method of chemical deoxygenation actually being used in the industry. They neither warned against the use of the Houghton process nor suggested that it did not work.

321. Moreover, some prior art in the record, such as Zanchi and Ellis, far from warning against use of the Houghton process, is complimentary of the process as it was used in practical applications at the time of these references.

vi. Copying and Acclamation Of The Invention.

322. The evidence indicates that Ecolochem's process was well-accepted within the water treatment industry and was copied by at least two of its competitors, Mobile Water Technology Corporation and Arrowhead Industrial Water, Inc.

323. The acceptance of Ecolochem's process, however, resulted from the PWR industry's recent increased interest in ambient temperature deoxygenation, and its unfamiliarity with the Houghton process, rather than from the novelty of Ecolochem's invention.

D. Prosecution History.

324. Ecolochem initially applied for its '492 patent on December 16, 1983, as application S.N. 562,001. Ecolochem asserted thirty-six claims, all of which were initially rejected by the Examiner.

325. Claims 1, 6, 8, 9, 17, 19-21, 26, 29, and 30 initially were rejected under 35 U.S.C. § 103 as being unpatentable over Bechtel or Houghton in view of a prior art reference by De Angelis.

326. Ecolochem represented to the Patent Examiner that the prior art, including Bechtel, was unsatisfactory

because it did not address the problem of the excess hydrazine left in the water in the Houghton process.

327. Contrary to Ecolochem's submission, however, the Bechtel reference explicitly acknowledged that, where activated carbon is used to catalyze the reaction between hydrazine and oxygen, any excess hydrazine would be removed by cation beds downstream of the carbon.

328. Ecolochem did not provide this portion of the Bechtel reference to the Patent Examiner. Exhibit 5 at 1.

329. The Patent Examiner also was not privy to the most pertinent prior art concerning the carbon contaminant removal step of the invention. Two other references which were not presented to the Examiner, Hassler and Hegde, unambiguously state that ion exchange with both cation and anion functionalities should be used after activated carbon to remove the dissolved contaminants given off by the carbon bed.

330. Without considering all the relevant prior art references and lacking a full record of the prior art, the Patent Examiner issued the claims of the '492 patent on December 3, 1985.

331. Months earlier, on July 26, 1985, Ecolochem had filed its first application for the '411 patent as a continuation of the '492 patent. Fourteen claims were asserted based upon either amendments of previous claims asserted under the prior application or as new claims. All of the first set of claims either were withdrawn or rejected.

332. In a supplemental amendment dated December 2, 1987, Ecolochem added new claims 41-61, which ultimately became issued claims 1-21. By this time, the Examiner had received the Bechtel reference and the Hassler reference, though he still did not have the Hegde or Demmitt references. Based on this art, the same Examiner who had issued the '492 patent refused to allow Ecolochem any additional

claims on the ground that the invention as a whole was obvious in light of the prior art.

333. At the time of this rejection, the trial in Ecolochem's lawsuit against Mobile Water Technology Co. had ended, although post-trial briefs had not been submitted.

334. In its post-trial briefs in the Mobile Water action, Ecolochem failed to disclose to the Court the rejection of its continuation claims. Instead, Ecolochem argued that the Examiner's earlier decision to issue the '492 patent should be considered as evidence of the validity of the invention. Ecolochem asserted, inter alia, (1) that the Examiner had had all the pertinent prior art before him at the time he considered the initial '492 patent; (2) that the Examiner would have been even more likely to hold the invention nonobvious if he had the evidence in the Mobile Water case before him; and (3) that "the reasons the Examiner allowed the patent to issue enjoy the same support and vitality now as they did then, and the considered and conscientious opinion of nonobviousness of the government's expert is entitled to befitting and undiminished respect."

335. Although the Mobile Water Court did not set aside its judgment upon learning of Ecolochem's failure to disclose the rejection of the continuation patent, it acknowledged that Ecolochem was "lacking in candor," and that the Court's "factfinding might have benefitted from consideration of the examiner's decision."

336. After prevailing in the Mobile Water case, Ecolochem immediately submitted the Court's opinion to the Examiner, and succeeded in persuading the Examiner to reverse his decision with regard to the claims of the continuation patent.

XVII. Expert Testimony on Obviousness.

337. Both Edison's Expert Irving Abrams, and Ecolochem's expert Herschel Klein, testified that if someone of ordinary skill in the art had been given the Houghton reference in 1982 and asked to make it usable in a high-pressure power plant, they would have come up with Ecolochem's invention.

XVIII. Facts Relevant to Anticipation.

338. In October 1980, Dr. Friedrich Martinola made a presentation to the 41st International Water Conference in Pittsburgh, Pennsylvania, and published two articles relating to his presentation.

339. The Martinola papers each bear the same title, "Saving Energy by Catalytic Reduction of Oxygen in Feedwater," and are in many respects identical.

340. They focus on a catalytic deoxygenation process for removing oxygen from water at ambient temperatures.

341. The particular process advocated in the article was the catalytic reduction of oxygen with hydrogen on a Lewatit resin. That process now is referred to as the Catalytic Oxygen Reduction System, or CORS process.

342. In touting the advantages of this process, the author compared it to the pre-existing Houghton process involving catalytic reduction of oxygen with hydrazine, which was then a method known and in use in Europe for deoxygenating water at ambient temperatures.

343. As described in the paper, both the hydrogen and hydrazine processes remove oxygen but add ionic contaminants to the deoxygenated water that must be removed prior to the water entering the steam generation system.

344. The comparison of the authors' proposed process with established processes carries over to Figure 10 of the

paper, entitled "Examples for the Use of Oxygenfree (sic) Water."

345. For the production of "Makeup Water for Boilers" and "Water for Nuclear Reactors," Figure 10 indicates (1) demineralization of raw water, (2) a catalyst column, and (3) a mixed bed.

346. As both the Figure 10 and Dr. Martinola's testimony demonstrate, the catalyst column is intended to contain either the Lewatit catalyst or activated carbon. The reactant can be either hydrogen or hydrazine.

347. The Martinola papers thus demonstrate the use of an activated carbon bed through which water (at ambient temperature) containing hydrazine is passed, followed by a mixed bed which removes the excess hydrazine and any ionic contaminants, such as salts, that were leached from the activated carbon bed. These are the same steps as the principal claims of Ecolochem's '411 patent.

CONCLUSIONS OF LAW

Based on the foregoing findings of fact, the Court makes the following conclusions of law.

I. Validity.

1. Under 35 U.S.C. § 282, a patent is presumed valid; however, the presumption of validity is only a procedural device that puts the burden of persuasion of invalidity on the alleged infringer. New England Braiding Co. v. A.W. Chesterton Co., 970 F.2d 878, 882 (Fed.Cir.1992); Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1534 (Fed.Cir.1983).

2. Consequently, the presumption of validity is not evidence which can be "weighed" against a challenger's evidence. New England Braiding Co., 970 F.2d at 882.

3. The challenger of the patent must present clear and convincing evidence of invalidity. Buildex, Inc. v. Kason Industries, Inc., 849 F.2d 1461, 1462 (Fed.Cir.1988).

4. Clear and convincing evidence consists of evidence that produces "an abiding conviction that the truth of [the] factual contentions [is] highly probable." Id. (quoting Colorado v. New Mexico, 467 U.S. 310, 316 (1984)). Only the facts underlying the obviousness determination must be established by clear and convincing evidence, not the ultimate legal conclusion itself. Newell Co., Inc. v. Kenney Mfg. Co., 864 F.2d 757, 767 (Fed.Cir.1988).

5. The presumption of validity is more easily overcome where pertinent prior art was not considered by the Patent Examiner. EWP Co. v. Reliance Universal, Inc., 755 F.2d 898, 905 (Fed.Cir.1985); Jervis B. Webb Co. v. Southern Systems, Inc., 742 F.2d 1388, 1392 (Fed.Cir.1984).

6. A prior adjudication wherein the previous challenger has failed to overcome the presumption of validity does not augment or enhance the presumption of validity. Mendenhall v. Cedarapids, Inc ., 5 F.3d 1557, 1571 (Fed.Cir.1993) (citing Shelcore, Inc. v. Durham Industries, Inc., 745 F.2d 621, 627 (Fed.Cir.1984)).

7. Neither the Demmitt reference nor the Hegde patent were considered on the issue of obviousness by the Patent Examiner or the court in Ecolochem v. Mobile Water Technology, 690 F.Supp. 778 (E.D.Ark.1988), aff'd 871 F.2d 1096 (Fed.Cir.1989).

II. Obviousness Pursuant to 35 U.S.C. § 103.

8. Patentability depends upon the non-obvious nature to a person of ordinary skill in the art of the subject matter sought to be patented. Graham v. John Deere Co., 383 U.S. 1, 14 (1966).

9. Pursuant to 35 U.S.C. § 103, "[a] patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

10. The closer a reference is to anticipating a claim, the more likely the claim is obvious. Cf. Connell v. Sears, Roebuck & Co., 722 F.2d 1542, 1548 (Fed.Cir.1983) (anticipation is the epitome of obviousness); accord In re Baxter Travenol Labs, 952 F.2d 388, 391 (Fed.Cir.1991) (anticipation is ultimate obviousness).

11. Obviousness is a question of law based on underlying factual determinations. Monarch Knitting Machinery Corp. v. Sulzer Morat GMBH, 139 F.3d 877, 881 (Fed.Cir.1998); see also Rockwell Corp. v. U.S., 147 F.3d 1358, 1362 (Fed.Cir.1998).

12. "In determining obviousness, the invention must be considered as a whole without the benefit of hindsight, and the claims must be considered in their entirety. [ ] Throughout the obviousness determination, a patent retains its statutory presumption of validity, see 35 U.S.C. § 282, and the movant retains the burden to show the invalidity of the claims by clear and convincing evidence as to the underlying facts." Rockwell, 147 F.3d at 1362.

13. Factual determinations relevant to obviousness include: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) the extent of any proffered objective indicia of nonobviousness. Id. (citing Graham, 303 U.S. at 17-18).

A. Scope of Prior Art.

14. The scope of the prior art is determined by reference to "the field of the inventor's endeavor" and the particular problem the inventor sought to resolve at the time the invention was made. Monarch, 139 F.3d at 881. "Defining the problem in terms of its solution reveals improper hindsight in the selection of the prior art relevant to obviousness." Id.

15. Unearthing long-neglected art, even if it is of considerable benefit to an industry, does not entitle the discoverer to patent protection. Sakraida v. AgPro, Inc., 425 U.S. 273, 282 (1976).

16. The issue of obviousness is determined by reference to a hypothetical person of ordinary skill in the art who is presumed to have knowledge of the entire scope of the prior art which is defined as that " 'reasonably pertinent to the particular problem with which the inventor was involved.' " Pentec, Inc. v. Graphic Controls Corp., 776 F.2d 309, 315 (Fed.Cir.1985); Stratoflex, 713 F.2d at 1535.

17. All of the prior art discussed in the Court's findings of facts is reasonably pertinent to the problem of ambient temperature deoxygenation and is, therefore, within the scope of relevant prior art.

18. Ecolochem's good fortune in obtaining the Houghton reference just as the EPRI guidelines created increased attention in the PWR industry to the problem of ambient temperature deoxygenation does not entitle Ecolochem to patent protection.

B. Level of Ordinary Skill in the Art.

19. An invention is obvious when the prior art suggests to one skilled in the art that it would be desirable to make the claimed invention. Ryko Mnf. Co. v. Nu-Star, Inc., 950 F.2d 714, 718 (Fed.Cir.1991).

20. The level of ordinary skill in a particular art is a question of fact. Id. Factors relevant to the inquiry include: (1) the educational level of the inventor; (2) the educational level of those who work in the relevant industry; and (3) the sophistication of the technology involved. Id.

21. As stated above, the Court's findings of fact establish that the level of ordinary skill in the art of water purification relevant to Ecolochem's invention was high.

C. Differences between Claimed Invention and Prior Art.

22. "In order to render a claimed apparatus or method obvious, the prior art must enable one skilled in the art to make and use the apparatus or method." Rockwell, 147 F.3d at 1365 (quoting Beckman Instruments, Inc. v. LKB Produkter AB, 892 F.2d 1547, 1551 (Fed.Cir.1989)).

23. Where no one prior art reference teaches the combination disclosed in the patent in suit, the moving party must show that combining the references "would suggest to one of ordinary skill in the art how to perform the missing process step with a reasonable likelihood of success." Id.

24. Where the differences between the prior art and the claim asserted are minor; the minor differences could be bridged by simple modifications; and the prior art references collectively suggest the engineering necessary to make those modifications, the differences are sufficiently insignificant to support the conclusion of obviousness. Id. (citing Miles Lab., Inc. v. Shandon, Inc., 997 F.2d 870, 878 (Fed.Cir.1993)).

25. The fact that a modification is simple does not, standing alone, establish that the invention was obvious. Gentry Gallery, Inc. v. Berkline Corp. 134 F.3d 1473, 1478 (Fed.Cir.1998).

26. "Obviousness cannot be determined by combining teachings of the prior art absent some teaching, suggestion

or incentive supporting the combination." Monarch, 139 F.3d at 882 (quoting Carella v. Starlight Archery, 804 F.2d 135, 140 (Fed.Cir.1986)).

27. On the other hand, an obviousness challenge cannot be overcome by the mere fact that the subject invention was the first time the features of the invention were combined. The combination itself must pass the test of § 103. Union Carbide Corp. v. American Can Co., 724 F.2d 1567 (Fed.Cir.1984).

28. The suggestion to combine the references may come solely from the common knowledge or common sense of one of ordinary skill in the art. In re Bozek, 416 F.2d 1385, 1390 (CCPA 1969).

29. Thus, when the prior art references together disclose all the elements of the claimed invention, and their combined teachings suggest to one of ordinary skill in the art the claimed combination, the claimed invention is obvious. In re Kulling, 897 F.2d 1147, 1149 (Fed.Cir.1990); Environmental Instr., Inc. v. Sutron Corp., 877 F.2d 1561, 1568 (Fed.Cir.1989); In re Raynes, 7 F .3d 1037, 1039 (Fed.Cir.1993).

30. Obviousness does not require absolute predictability. Only a reasonable expectation that the beneficial result of the invention will be achieved is necessary to show obviousness. In re Merck & Co., 800 F.2d 1091, 1097 (Fed.Cir.1986).

31. Taken together, the prior art references relevant to Ecolochem's invention disclose all of the elements of the claimed invention, and their combined teachings would have suggested to one of ordinary skill in the art that the Houghton process could be followed by the use of mixed bed ion exchange resins to provide ambient temperature deoxygenation and remove excess hydrazine as well as dissolved and undissolved carbon contaminants.

D. Objective Indicia of Non-obviousness.

32. Objective indicia of non-obviousness, or secondary considerations, are not secondary in importance. Ryko, 950 F.2d at 719.

33. Secondary considerations can include evidence of commercial success, a long-felt but unsolved need for the invention, and failure by others to make the invention. Graham, 383 U.S. at 17-18.

34. Evidence of secondary considerations must be considered under section 103 as part of the totality of the evidence used to reach the ultimate conclusion on the question of obviousness, but such evidence does not control the obviousness determination. Richardson-Vicks, Inc. v. Upjohn Co., 122 F.3d 1476, 1483 (Fed.Cir.1997) (citing Newell Cos. v. Kenney Mfg. Co., 864 F.2d 757, 768 (Fed.Cir.1988)).

35. A nexus must be shown between the merits of the claimed invention and any evidence of secondary considerations of nonobviousness for it to suggest the validity of a patent. Stratoflex, 713 F.2d at 1539.

36. The burden of proof as to this connection or nexus rests with the patentee. Demaco Corp. v. F. Von Langerdorff Licensing Ltd., 851 F.2d 1387, 1392 (Fed.Cir.1988).

37. Consequently, "a 'secondary consideration' must be carefully appraised as to its evidentiary value[.]" EWP, 755 F.2d at 908 (internal quotation marks omitted).

i. Long-felt but Unsolved Need.

38. "The relevant secondary consideration is 'long-felt but unsolved need,' not long-felt need in isolation." Monarch, 139 F.3d at 884.

39. To establish the existence of a long-felt need, the patentee must establish a recognized and persistent problem in the relevant art. 2 Chisum on Patents § 5.05[1] at 5-572 (1997).

40. The findings of fact do not support Ecolochem's contention that there was a long-felt but unsolved need to create an ambient temperature deoxygenation process for use in start up and restart of nuclear power facilities.

41. Moreover, even if there had been a long-felt, unsolved need, the required nexus between the claimed invention and the long-felt need is attenuated by the increased market demand resulting from adoption of the EPRI guidelines in 1982. Cf. Universal Oil Prod. Co. v. Globe Oil & Ref. Co., 322 U.S. 471 (1944); Owens-Illinois, Inc. v. Emhart Industries, Inc., 644 F.2d 98, 100 (2d Cir.1981).

ii. Commercial Success.

42. Even where the evidence reflects that a patented product or process is highly successful, a strong case of obviousness based on admissions and teachings of the prior art will support an obviousness finding, particularly where some of the relevant art was not considered during the patent prosecution. Newell, 864 F.2d at 768-69; EWP, 755 F.2d at 908; Richardson-Vicks, 122 F.3d at 1489.

43. For a claimed invention's commercial success to be given weight, a nexus must be established between the alleged commercial success and the merits of the claimed invention. Pentec, 776 F.2d at 315 (citing Cable Elec. Products, Inc. v. Genmark, Inc., 770 F.2d 1015, 1026 (Fed.Cir.1985)).

44. Commercial success must be shown to have in some way been due to the nature of the claimed invention, as opposed to other economic and commercial factors unre-

lated to the technical quality of the patented subject matter. Cable Elec., 770 F.2d at 1027.

45. Merely proving the number of sales of the patented product is insufficient to establish the required nexus for commercial success. In re Baxter, 952 F.2d at 392; Kansas Jack, Inc. v. Kuhn, 719 F.2d 1144, 1150 (Fed.Cir.1983).

46. The Court's findings of fact establish that Ecolochem's limited commercial success with its patented process was primarily attributable to (1) Ecolochem's ability to meet the need in the PWR industry for short-term emergency services through its Mobile Flow service; (2) Ecolochem's ability to provide deoxygenation services while PWR plants built permanent deaeration equipment to meet new EPRI standards; (3) Ecolochem's head start in marketing mobile deoxygenation treatment services through use of its patented Mobile Flow trailer; (4) the increased blowdown rates that resulted from the 1982 tightening of EPRI guidelines for salts in the steam generator.

47. In short, Ecolochem's commercial success was due not to the nature of the claimed invention, but to other economic and commercial factors unrelated to the technical quality of the patented process.

iii. Failure of Others to Make Invention.

48. While the failure of others to make the invention may be evidence of nonobviousness, an unsolved problem is not evidence of unobviousness unless skilled workers in the art have tried and failed to solve the problem. In re Allen, 324 F.2d 993, 997 (C.C .P.A.1963).

49. Failures that occurred prior to publication of the most relevant prior art are wholly irrelevant. Graham, 383 U.S. at 36; Newell, 864 F.2d at 768.

50. As the Court's findings of fact establish, Ecolochem did not show that others tried but failed to make Ecolochem's invention.

iv. Simultaneous Invention.

51. The fact that a person of ordinary skill in the art independently and contemporaneously developed a patent holder's claimed invention is relevant evidence that the patent is obvious. Merck, 800 F.2d at 1098.

52. The Court's findings of fact establish that prior to issuance of Ecolochem's patent, Todd Hook of NWT independently combined the Houghton process with a mixed bed ion exchange resin, thereby independently developing Ecolochem's invention.

v. Teaching Away.

53. A known or obvious combination does not become patentable simply because it has been described as somewhat inferior to some other product for the same use. In re Guley, 27 F.3d 551, 553 (Fed.Cir.1994).

54. A prior art reference does not teach away from an invention where it neither warns a person of ordinary skill against the improvement contained in the invention nor teaches that the improvement cannot or should not be made. Para-Ordnance Mfg., Inc. v. SGS Importers Int'l, Inc., 73 F.3d 1085, 1090 (Fed.Cir.1995), cert. denied, ____ U.S. ____, 117 S.Ct. 80 (1996).

55. Where a patentee contends that particular prior art references teach away from its invention, the teachings must be weighed alongside the other relevant teachings, and a finding of teaching away is not indicated where such other references teach the propriety of the patented improvement. Id.

56. "A prior artreference may be considered to teach away when 'a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.' General skepticism of those in the art — not amounting to teaching away — is also 'relevant and persuasive evidence' of nonobviousness." Monarch, 139 F.3d at 885 (citations omitted).

57. Ecolochem presented no evidence that the prior art expressed skepticism concerning the efficacy of using the Houghton process or of combining the Houghton process with ion exchange.

58. Likewise, the Court's findings of fact establish that the prior art did not teach away from Ecolochem's invention.

vi. Copying and Acclamation.

59. Copying and laudatory statements should be given little if any weight in determining obviousness. 2 Chisum on Patents, § 5.05[5] at 5-629 & 5-630; Vandenberg v. Dairy Equipment Co., 740 F.2d 1560, 1567 (Fed.Cir.1984); Cable Elec., 770 F.2d at 1028.

60. Although the Court's findings of fact indicate that Ecolochem's process was warmly received in the water treatment industry and was copied by at least two competitors, that copying did not result from the novelty of Ecolochem's invention and is of little weight in assessing obviousness.

vii. Prosecution History.

61. An arduous prosecution history supports an obviousness determination. Phillips Elec. & Pharmaceutical Indus. Corp. v. Therman & Elec. Indus., Inc., 450 F.2d 1164, 1175 (3d Cir.1972).

62. As the Court's findings of fact indicate, the prosecution histories for Ecolochem's '492 and '411 patents were protracted, supporting a finding of obviousness.

E. Conclusion of Obviousness.

63. Based on the Court's findings of fact, the asserted claims of Ecolochem's '411 patent rise or fall together with respect to the question of obviousness because (1) each of the independent claims 1, 15 and 20 is ultimately based on the obvious combination of the Houghton process for deoxygenation with a mixed bed ion exchange resin to remove excess hydrazine and/or dissolved and/or undissolved carbon contaminants; and (2) none of the dependent claims includes an additional element that would suffice to make the dependant claim nonobvious.

64. In light of the Court's findings of fact based on clear and convincing evidence regarding the scope and content of the relevant prior art; the high level of ordinary skill in the art; the minimal differences between the claimed invention and the prior art; and the secondary considerations relevant to the question of obviousness, the Court concludes as a matter of law that Edison has met its burden of proof on the ultimate question of obviousness and that claims 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18, and 20 of United States Patent No. 4,818,411 (the " '411 patent") are obvious and therefore invalid under section 103. Given the procedural posture of this case, the Court specifically concludes that the secondary considerations do not outweigh Edison's prima facie showing of obviousness.

III. Anticipation Pursuant To 35 U.S.C. § 102.

65. Prior art under 35 U.S.C. § 102 renders a patent invalid when it "anticipates" the claimed invention. A prior art reference that contains each and every element of the claimed invention explicitly or inherently anticipates the

claimed invention. In re Schreiber, 128 F.3d 1473, 1477 (Fed.Cir.1997); Rockwell, 147 F.3d at 1363-64.

66. Under 35 U.S. C. § 102(a), a patent is invalid if the claimed invention was "known . . . by others in this country . . . before the invention thereof by the applicant."

67. Whether a claimed invention is anticipated by prior art is a question of fact. Schreiber, 128 F.3d at 1477. Likewise, "whether a claim limitation is inherent in a prior art reference is a factual issue[.]" Id.

68. Under 35 U.S.C. § 102(b), a patent is also invalid if the claimed invention was disclosed in a printed publication over a year before the patentee filed the patent application.

69. In addition to disclosing every limitation of the claimed invention, the description in the prior art reference must be sufficient to place the public in possession of the invention, thereby enabling the public to practice the invention. A printed publication is enabling, and thus anticipating, if it sufficiently describes the claimed invention such that "one of ordinary skill in the art could have combined the publication's description of the invention with his own knowledge to make the claimed invention." In re Donohue, 766 F.2d 531, 533 (Fed.Cir.1985).

70. It is not, however, necessary that an invention disclosed in a publication shall have been actually made in order to satisfy the enablement requirement. Id.

71. This Court previously has found, in a decision affirmed by the Federal Circuit, that claims 1, 2, 5, 6, and 9 of Ecolochem's original '492 patent and claim 21 of Ecolochem's continuation '411 patent are anticipated by the Demmitt reference and are therefore invalid. Ecolochem, Inc. Southern California Edison Co., 863 F.Supp. 1165 (C.D.Ca.1994), aff'd in part, rev'd in part, 91 F.3d 169 (Fed.Cir.1996).

72. The public presentation by Dr. Martinola in Pittsburgh in October of 1980 constitutes prior art under 35 U.S.C. § 102(a) and the distribution of his paper at that time also constitutes prior art under 35 U.S.C. § 102(b).

73. In Mobile Water, the Federal Circuit affirmed, in an unpublished decision, the district court ruling that the Martinola reference did not anticipate the '492 patent because Martinola did not disclose all the elements of Ecolochem's claimed invention. Mobile Water, 1989 WL 16031 (Fed.Cir. Feb. 24, 1989).

74. Although the Court has closely considered this persuasive authority, and particularly the reasoning of the district court's ruling on anticipation, the Court respectfully disagrees with the district court's conclusion in Mobile Water that because Diagram 10 is positioned on the page following the heading "Application of oxygen reduction in water with hydrogen" and the associated text, Diagram 10 necessarily refers exclusively to reduction of oxygen in water with hydrogen and not to reduction of oxygen with hydrazine in an activated carbon column. See Exh. 748.

75. In a section on comparative costs of various techniques for oxygen removal, the Martinola reference discusses the Houghton process and points out that when using activated carbon as a catalyst to react dissolved oxygen with hydrazine one must take into account "that the carbon releases salts into the demineralized water." Ex. 748 at 81.

76. Figure 9 of the Martinola article is a cost comparison chart indicating that reduction with hydrogen and a palladium catalyst is significantly less expensive than reduction with hydrazine and an activated carbon catalyst which in turn is cheaper than using a vacuum degassifier.

77. There is no room for Figure 10 at the bottom of page 81 because Figure 9 extends too far down the page. Following Figure 9 is a brief conclusion to the article, in

which the authors recommend use of the Lewatit system whenever deoxygenation is to be carried out at ambient temperatures.

78. Figure 10 is set at the top of the next page with the following caption: "Fig. 10 shows a few suggested applications. It also includes systems for the simultaneous treatment of water with ion exchange resins and oxygen reduction with catalysts." Id. at 82. Thus, Figure 10 refers generally to methods of deoxygenating and purifying water by (1) reducing dissolved oxygen via catalysis and (2) removing contaminants via ion exchange.

79. The labeling of the third prong of Figure 10 substantiates this reading. Rather than specifying that the second step of the process should be the use of a palladium catalyst, which would indicate that the diagram refers exclusively to the hydrogen-palladium process presented in the article, Martinola's diagram uses generic terms for the three basic steps to purify water for use in nuclear reactors and other industries: demineralize, catalyst column, mixed bed.

80. Martinola does not elaborate on the type of "salts" released by the activated carbon.

81. Ecolochem argues that the Martinola reference fails to disclose that the "salts" released are dissolved and undissolved activated carbon contaminants and that the purpose of the mixed bed is to remove those contaminants. The evidence at trial established, however, that activated carbon was known as a "dirty material" and that use of a mixed bed to remove carbon contaminants was well known in the field. Consequently, one of ordinary skill in the art of water purification would have known, and the Martinola reference implicitly discloses, that the "salts" released in the Martinola reference are dissolved and undissolved activated carbon contaminants and that the purpose of the mixed bed is to remove those contaminants.

82. The fact that Martinola did not make Ecolochem's invention, and instead focused on the hydrogen-palladium method of deoxygenation is not relevant.

83. The Martinola article discloses (1) the passage of water containing dissolved oxygen and hydrazine over a bed of activated carbon to catalyze a reaction between the oxygen and hydrazine; (ii) the release of dissolved ionic contaminants by the carbon bed into the liquid; and (iii) the passage of the liquid through a mixed bed ion exchange resins to remove those contaminants.

84. The Martinola article therefore anticipates claim 20 of the '411 patent.

85. The evidence at trial also established that removal of excess hydrazine by use of downstream cation exchange was well known. The Martinola reference explicitly states that an amount of hydrazine in excess of the stoichiometric amount is necessary to completely deoxygenate the water when catalyzing the oxygen-hydrazine reaction with activated carbon. Consequently, one of ordinary skill in the art of water purification would have known, and the Martinola reference implicitly discloses, that the mixed bed also served to remove excess hydrazine.

86. The Martinola article therefore anticipates claim 1 of the '411 patent.

87. The Martinola article also explicitly or inherently discloses that: (a) the carbon bed also gives off undissolved contaminants that are removed by the ion exchange resins acting as a filter (claim 4); (b) the temperature of the liquid is between freezing and the temperature at which the ion exchange resins would be damaged (claim 7); Copr. the liquid deoxygenated by the process is water (claim 8); (d) the deoxygenated liquid is circulated through power generating apparatus (claim 9); (e) the hydrazine used is uncatalyzed hydrazine (claim 10); (f) the hydrazine is

added to the liquid upstream of the carbon bed (claim 11); and (g) a two-step demineralizer is used upstream of the carbon bed (claim 12).

88. Thus, Martinola sufficiently describes the variations of the claimed invention such that "one of ordinary skill in the art could have combined the publication's description of the invention with his own knowledge to make the claimed invention." Donohue, 766 F.2d at 533. The Martinola article therefore also anticipates claims 4, 7, 8, 9, 10, 11, and 12 of the '411 patent.

89. Martinola stated at his deposition that during his presentation at the 1980 conference he used Figure 10 of his diagram as a slide and discussed "the use of a mixed bed ion exchange resin after hydrazine and activated carbon" for the same purposes and uses described in Ecolochem's patents. Martinola Dep. at 18:16-19:6. This testimony is undisputed and establishes that the Martinola presentation, like the paper, anticipated Ecolochem's '411 patent claims 4, 7, 8, 9, 10, 11, 12, and 20.

IV. Infringement.

90. Whoever makes, uses, offers to sell or sells any patented invention, without authority from the patent owner, infringes the patent. 35 U.S.C. § 271(a).

91. The patentee has the burden of establishing infringement by a preponderance of the evidence. Smith Kline Diagnostics, Inc. v. Helena Laboratories Corp., 859 F.2d 878, 889 (Fed.Cir.1988).

92. Literal infringement is made out where each limitation of a claim as construed is found in an alleged infringing article, device or process. Laitram Corp. v. Rexnord, Inc., 939 F.2d 1533, 1535 (Fed.Cir.1991).

93. Before a court can determine whether the claims of a patent cover an accused process, it must construe the claims

to determine their scope. Markman v. Westview Instruments, Inc., 116 S.Ct. 1384 (1996).

94. This Court has previously determined that the claims of the '411 patent cover a "series of functions used to reduce or eliminate oxygen dissolved in a liquid." 6/12/97 Order Construing Claims of United States Patent No. 4,818,411, at p. 3.

95. When claimed limitations are not present in an alleged infringing device or process, there can be no literal infringement. Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 933 (Fed.Cir.1987).

96. Edison contacts a liquid containing hydrazine and dissolved oxygen with a bed of activated carbon whereby the activated carbon catalyzes a reaction between the hydrazine and the dissolved oxygen and further whereby dissolved and undissolved carbon contaminants are added to the liquid, and then passes that liquid mixture through a cation ion exchange resin and an anion ion exchange resin to remove at least the dissolved carbon contaminants.

97. Edison practices of claims 1, 3-13, 15, 17, 18 and 20 of the '411 patent, thereby infringing those claims of the '411 patent.

98. Edison literally infringes claims 1, 3-13, 15, 17, 18 and 20 of the '411 patent by practicing a process at SONGS that includes all the elements of those claims. None of Edison's asserted defenses impede a finding of literal infringement.

A. Imperfect Practice of the Invention.

99. Additions or improvements to an accused device will not preclude a finding of infringement if all the limitations in the patent claims are present in the accused device. Atlanta Motoring Accessories, Inc. v. Saratoga Tech., Inc., 33 F.3d 1362, 1366 (Fed.Cir.1994); see also Uniroyal Inc. v.

Rudkin- Wiley Corp., 837 F.2d 1044, 1057 (Fed.Cir.1988); Texas Instruments, Inc. v. United States Int'l Trade Comm., 805 F.2d 1558, 1563 (Fed.Cir.1986); Atlas Powder Co. v. E.I. de Pont de Nemours & Co., 750 F.2d 1569, 1581 (Fed.Cir.1984); Amstar Corp. v. Envirotech Corp., 730 F.2d 1476, 1482 (Fed.Cir.1984).

100. Edison does not avoid infringement by using a vacuum degassifier to deoxygenate the ambient temperature makeup water of its HFMUD after it has utilized Ecolochem's patented process.

101. Likewise, infringement is not avoided merely because the infringer uses the accused process to perform functions in addition to those performed by the process as claimed. Insta-Foam Products, Inc. v. Universal Foam Systems, Inc., 906 F.2d 698, 702 (Fed.Cir.1990) ("[I]nfringement . . . is not precluded merely because the accused device performs [additional] functions").

102. Edison's intent to purportedly use Ecolochem's patented process for TOC removal rather than dissolved oxygen removal does not absolve it from liability for infringement.

103. The imperfect practice of a patented invention does not avoid infringement. Paper Converting Machine Co. v. Magna-Graphics Corp., 745 F.2d 11, 20 (Fed.Cir.1984) (practicing claimed invention at less than the optimal efficiency still constitutes infringement). Likewise, "an accused product that sometimes, but not always, embodies a claimed method nonetheless infringes." Bell Communications Research, Inc. v. Vitalink Communications Corp., 55 F.3d 615, 622 (Fed.Cir.1995).

104. Edison's imperfect practice of Ecolochem's invention by adding less than a stoichiometric amount of hydrazine nevertheless infringes Ecolochem's patented process.

B. Use of Extra-Stoichiometric Amount of Hydrazine Not Required.

105. Edison contends that the deoxygenation process claimed in the '411 patent requires the use of more than a stoichiometric amount of hydrazine.

106. Ecolochem responds that the patented process claimed may be used not only to eliminate but to reduce dissolved oxygen.

107. In determining the proper construction of a claim, "the court should look first to the intrinsic evidence of record, i.e., the patent itself, including the claims, the specification, and if in evidence, the prosecution history." Kegel Co. v. AMF Bowling, Inc., 127 F.3d 1420, 1426 (Fed.Cir.1997) (citing Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed.Cir.1996)); Gentry Gallery, Inc. v. Berkline Corp., 134 F.3d 1473, 1476 (Fed.Cir.1998).

108. In its Order Construing Claims, the Court erroneously suggested that it need not consider the prosecution history of the '411 patent in light of the clear meaning of the disputed terms based on the claim language and the specification. See Lemelson v. United States, 752 F.2d 1538, 1550 (Fed.Cir.1985).

109. Arguments made during prosecution regarding the meaning of a claim term are relevant to the interpretation of that term in every claim of the patent absent a clear indication to the contrary. Southwall Technologies, Inc. v. Cardinal IG Co., 54 F.3d 1570, 1579 (Fed.Cir.1995).

110. Nonetheless, the prosecution history may not be used to "enlarge, diminish, or vary the limitations in the claims." Vitronics, 90 F.3d at 1482.

111. Upon review of the prosecution history, the Court concludes that Edison's use of the prosecution history con-

stitutes an improper attempt to enlarge the limitations of the claims.

112. During the prosecution of the '492 patent, Ecolochem submitted an apparatus claim, claim 33, which read as "a deoxygenation apparatus for the process of claim 10, comprising a conduit for carrying said liquid, a means for adding hydrazine to said conduit, a bed of activated carbon in communication with said conduit, and a bed of said ion exchange resin in communication with said conduit." Exh. 40 at 18-19 (emphasis added).

113. This claim was rejected because, among other reasons, as an apparatus claim, it could not properly depend from a process claim such as claim 10. Exh. 40 at 50.

114. In response, Ecolochem modified claim 33 to read, "a deoxygenation process for deoxygenating a liquid comprising a conduit for carrying said liquid, a means for adding hydrazine to said conduit," wherein said means for adding is adapted to add an excess amount of hydrazine for reacting with dissolved oxygen contained in said liquid such that an amount of unreacted hydrazine remains in said liquid following said reaction . . . ." Exh. 40 at 57-58 (emphasis added).

115. Ecolochem represented to the Patent Office that claim 33 had been amended "without adding any function language that was not already effectively included in the claim[ ] by way of [its] dependenc[y] on the respective process claim[ ]." Exh. 40 at 60-61.

116. Ecolochem further represented that the amendment to claim 33 did not present any significantly new issues and that "the original apparatus claim effectively contained all of the limitations that are now expressly recited in the amended claim[ ]." Exh. 40 at 61.

117. Claim 10, which ultimately issued as claim 8 of the '492 patent, did not explicitly state that an excess of hydra-

zine was required. Rather, claim 10, like the other claims in suit, merely referred to a "deoxygenation process" comprising the two steps of Ecolochem's invention. Exhs. 5, 40.

118. Edison contends that Ecolochem's representations to the Patent Examiner regarding modified claim 33 require that the term "deoxygenation process" in the '411 patent be limited to a process for complete removal of dissolved oxygen by the addition of an extra stoichiometric amount of hydrazine. This argument is an improper attempt to enlarge the limitations set forth in the claims and supported by the Court's interpretation of the specification.

119. Edison's arguments based on the prosecution history (made both in the post-trial papers and in the original papers submitted in conjunction with the motion to construe the claims of the '411 patent) would improperly enlarge the limitations in the claims, stripping the '411 patent of its natural scope.

120. The Court declines Edison's invitation to reconsider its analysis of the '411 patent claims and specification. For the reasons stated in the Court's Order Construing Claims of United States Patent No. 4,818,411 ("Order Construing Claims"), as clarified by these Findings of Fact and Conclusions of Law, the term "deoxygenation process" in the '411 patent means a series of functions used to reduce or eliminate oxygen dissolved in a liquid.

V. Reverse Doctrine of Equivalents.

121. The reverse doctrine of equivalents is an equitable doctrine justifying a finding of non-infringement when an accused product literally falls within the language of the patent claims but is so changed in principle that a finding of infringement would be inequitable. Texas Instr. v. U.S. Intern. Trade Comm'n, 846 F.2d 1369, 1371 (Fed.Cir.1988).

122. "Just as the purpose of the 'doctrine of equivalents' is to prevent 'pirating' of the patentee's invention, [ ] so the purpose of the 'reverse' doctrine is to prevent unwarranted extension of the claims beyond a fair scope of the patentee's invention." Scripps Clinic & Research Foundation v. Genentech, Inc., 927 F.2d 1565, 1581 (Fed.Cir.1991).

123. "The reverse doctrine of equivalents flows from the Supreme Court's statement in Graver Tank that an accused article may avoid infringement, even if it is within the literal words of the claim, if it is "so far changed in principle from a patented article that it performs the same or a similar function in a substantially different way." Id. (quoting Graver Tank & Mnf. Co. v. Linde Air Prod. Co., 339 U.S. 605, 608-09 (1950)).

124. The reverse doctrine of equivalents has also been held to apply where an accused product is neither intended to perform the function of the disclosed invention nor does so. See Leesona Corp. v. United States, 530 F.2d 896 (Ct.Cl.1976).

125. In this latter situation, any effect of the device on the problem addressed by the invention would be "incidental and entirely insignificant," and the reverse doctrine of equivalents operates to protect the alleged infringer from an inequitable application of the patent claims. Id.

126. To apply the reverse doctrine, we consider facts specific to the accused device and weigh them against the equitable scope of the claims. Id.

127. Thus, "the accused device must be sufficiently different from that which is patented that despite the apparent literal infringement, the claims are interpreted to negate infringement." Texas Instruments, 846, F.2d at 1371.

128. Edison contends that its HFMUD system does not infringe the '411 claims at issue, despite the fact that the

elements of the claims literally read on the HFMUD water purification system, because the deoxygenation in the HFMUD is accomplished by a vacuum degassifier.

129. According to Edison, it uses hydrazine with an activated carbon catalyst followed by a mixed bed ion exchange resin for a purpose unrelated to deoxygenation, namely the removal of TOC.

130. Thus, Edison argues, the partial deoxygenation that results from Edison's use of the patented process is incidental to Edison's purpose, and under the reverse doctrine of equivalents, the HFMUD system is not infringing.

131. Edison's use of hydrazine with activated carbon followed by a mixed bed ion exchange resin is not "so far changed in principle" from Ecolochem's patented device that it performs the same or a similar function in a substantially different way.

132. An alleged infringer may not escape infringement by using the structure of a claimed invention in a way that merely differs from the embodiment described in the specification. SRI Int'l v. Matsushita Elec. Corp., 775 F.2d 1107, 1122-23 (Fed.Cir.1985).

133. Edison does not avoid infringement under the reverse doctrine of equivalents because Ecolochem's claims literally read on Edison's accused process and Edison's process performs, at least in part, the same function as Ecolochem's patented invention, namely the removal of dissolved oxygen. See Smithkline Diagnostics, Inc. v. Helena Labs. Corp., 859 F.2d 878, 889 (Fed.Cir.1988).

134. Edison does not escape infringement under the reverse doctrine of equivalents merely because it also uses the hydrazine and activated carbon for a purpose other than deoxygenation. See SRI, 775 F.2d 1107.

135. Edison cannot rely on its use of a deaerator to shoehorn its literal infringement into a reverse doctrine of equivalents defense.

VI. Willfulness.

136. A patentee seeking enhanced damages under 35 U.S.C. § 285 must establish by clear and convincing evidence that the infringement was willful.

137. "The issue of willful infringement is resolved by evaluating the totality of the surrounding circumstances. [ ] Where an infringer has actual notice of a patentee's rights, the infringer has an affirmative duty of due care [ ] which normally includes the duty to seek and obtain competent legal advice from counsel regarding the potential infringement. [ ] Whether infringement is willful is a question of intent." Ortho Pharmaceutical Corp. v. Smith, 959 F.2d 936, 944 (Fed.Cir.1992) (citations omitted).

138. To assess whether an alleged infringer has satisfied the duty of due care, the trial court must determine "whether under all the circumstances, a reasonable person would prudently conduct himself with any confidence that a court might hold the patent invalid or not infringed." Ryko, Inc. v. Ag-Bag Corp., 857 F.2d 1418, 1428 (Fed.Cir.1988).

139. In assessing whether an infringer has met its duty of due care, the courts should consider:

a. Whether the infringer deliberately copied the ideas or designs of another. Bott v. Four Star Corp., 807 F.2d 1567. 1571 (Fed.Cir.1986), overruled on other grounds, A.C. Auckerman Co. v. Chiades Const. Co., 960 F.2d 1020 (Fed.Cir.1992); Stryker Corp. v. Intermedics Orthopedics Inc., 96 F.3d 1409, 1414 (Fed.Cir.1996) (proper inquiry is whether infringer intentionally or deliberately copied, not whether infringer engaged in "slavish copying").

b. Whether the infringer's behavior in the litigation was consistent with an overall finding of good faith. Id.

c. Whether the infringer had actual knowledge of an existing patent. Power Lift, Inc. v. Lang Tools, 774 F.2d 478, 482 (Fed.Cir.1985)

d. Whether the infringer had a good faith belief that the patent was invalid or not infringed. Id.

e. Whether the infringer made a good faith effort to design around the patent. Amstar Corp v. Envirotech Corp., 823 F.2d 1538, 1546 (Fed.Cir.1987).

f. Whether the infringer received a competent opinion of counsel. Ryko, 857 F.2d at 1428.

140. A good faith, though erroneous, belief that the patent was invalid or not infringed will preclude a willfulness finding, even if legal counsel was not consulted in forming those beliefs. Rolls Royce Ltd. v. GTE Valeron Corp., 800 F.2d 1101, 1109 (Fed.Cir.1986).

141. The existence and competency of an opinion of counsel is in turn judged by such factors as:

a. Whether the opinion was rendered too late to be reasonably relied upon by the alleged infringer. American Medical Systems, Inc. v. Medical Engineering Corp., 794 F.Supp. 1370, 1398 (E.D.Wis.1992) aff'd in part, rev'd in part, 6 F.3d 1523, 1531 (Fed.Cir.1993); Del Mar Avionics v. Quinton Instruments Co., 836 F.2d 1320, 1328 (Fed.Cir.1987) (willfulness found where infringer did not consult attorney until five months after receiving notice of infringement).

b. Whether the opinion followed a review of material information on validity and infringement. Datascope Corp. v. SMEC, Inc., 879 F.2d 820, 828 (Fed.Cir.1989), cert. denied, 110 S.Ct. 729 (1990); Amsted Industries

Inc. v. Buckeye Steel Castings Co., 24 F.3d 178, 182 (Fed.Cir.1993);

c. Whether the opinion was in writing. Minnesota Mining & Manufacturing Co. v. Johnson & Johnson Orthopedics, Inc., 976 F.2d 1559, 1580 (Fed.Cir.1992) (oral opinions disfavored).

d. Whether the opinion consists of conclusory statements without supporting reasons. Bott, 807 F.2d at 1572.

142. Edison had actual notice of Ecolochem's patent rights and the fact that Ecolochem believed the HFMUD, as designed, would infringe its patent, but Edison nevertheless proceeded to deliberately infringe without first obtaining an opinion of counsel and without a reasonable basis for a good faith belief that a court might hold the patent invalid or not infringed.

143. Thus, Edison violated its secrecy agreement with Ecolochem; intentionally copied Ecolochem's patented process; lacked any reasonable basis for a belief that the HFMUD did no infringe; and only belately obtained an opinion from counsel.

144. Based on the clear and convincing evidence adduced at trial, the Court concludes that Edison wilfully infringed claims 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18, and 20 of Ecolochem's '411 patent.

VII. Laches.

145. Laches bars recovery of past damages up to the date a lawsuit is filed where the patent owner has inexcusably sat on its rights. A.C. Aukerman Co. v. R.L. Chaides Constr. Co., 960 F.2d 1020, 1032 (Fed.Cir.1992) (en banc).

146. The elements of laches are (1) a delay in filing suit for an unreasonable and inexcusable length of time from the time the plaintiff knew or reasonably should have known of

its claim against the defendant; and (ii) prejudice or injury to the defendant as a result of the delay. Id.

147. The period of delay is measured from the time the plaintiff knew or reasonably should have known of the alleged infringing activities, but no earlier than the issue date of the patent. Id. at 1037-39.

148. A presumption of laches arises, absent other considerations, from a greater than six year delay in filing suit after the patent owner knew or should have known of the defendant's allegedly infringing activity. Id. at 1032.

149. Where the presumption is in effect, unreasonable delay and prejudice are presumed and the patent owner has the burden of going forward with evidence to meet or rebut the presumption. The presumption does not shift to the patentee the burden of proof on the issue of laches. Id.

150. If the patent owner offers evidence that the delay has not in fact been six years, no presumption arises Id. at 1333.

151. In determining whether a laches defense has merit, the court must consider the particular facts of the case and weigh the equities of the parties. Id. at 1032.

152. "Material prejudice to adverse parties resulting from the plaintiffs delay is essential to the laches defense. Such prejudice may be either economic or evidentiary." Id. at 1033.

153. A laches defense requires proof of a nexus between the patentee's unreasonable delay in bringing suit and the alleged infringer's change in economic position during the period of delay. Gasser Chair Co., Inc. v. Infanti Chair Manufacturing Corp., 34 USPQ2d 1822, 1825 (Fed.Cir.1995).

154. It is not enough that the alleged infringer changed his position, e.g., by investing in production of an allegedly

infringing device. The change must be because of and as a result of delay, not simply a business decision to capitalize on a market opportunity. Hemstreet v. Computer Entry Sys. Corp., 972 F.2d 1290, 1294 (Fed.Cir.1992).

155. The court must also consider any justification offered by plaintiff for its delay. Aukerman, 960 F.2d at 1032-33.

156. Involvement in other litigation may be a legitimate justification for delay. Id. (citing Jamesbury Corp. v. Litton Industrial Products, Inc., 839 F.2d 1544, 1552-53 (Fed.Cir.1988)).

157. Specifically, delay can be excused when an accused infringer is put on notice that it can expect to be sued after other litigation is resolved. Adelberq Labs, Inc. v. Miles, Inc., 921 F.2d 1267, 1272 (Fed.Cir.1992).

158. A plaintiff may not justify delay by arguing that an earlier assertion might have jeopardized its business dealings with the defendant. Cf. MCV, Inc. v. King-Seeley Thermos Co., 870 F.2d 1568, 1572 (Fed.Cir.1989) (applying cited rule of laches in context of equitable estoppel defense asserted against alleged co-inventor seeking rights to patent).

159. Ecolochem's delay is not properly measured from December 1985, when Ecolochem learned of the design for the HFMUD. The test is based on when Ecolochem knew or should have known of Edison's infringement, not when Ecolochem knew of should have known that Edison might build the HFMUD in such a way that Edison would infringe the patent once Edison began using the HFMUD.

160. Rather, Ecolochem's delay is properly measured from August 1986, when Ecolochem first knew of the alleged infringing activities, until June 1992, when Ecolochem filed suit.

161. Ecolochem's delay was not based on Ecolochem's desire to maintain a lucrative business relationship with Edison. Rather, Ecolochem's delay was based on its legitimate desire to resolve other pending litigation involving the patented invention.

162. Edison had actual notice that Ecolochem believed the design of the HFMUD infringed its patents and that Ecolochem planned to resolve other litigation before asserting its claims against Edison.

163. Ecolochem is not guilty of laches in waiting until 1992 to file this action because Ecolochem promptly notified Edison of its concerns that Edison's operations at SONGS might constitute an infringement, and promptly provided Edison with a copy of its first deoxygenation patent. Furthermore, from 1985 through 1992, Ecolochem was involved in and notified Edison about two other law suits involving its patented process.

164. Moreover, Edison has not shown that it was materially injured as a result of Ecolochem's delay in filing suit.

165. Finally, Edison's willfulness in infringing the '411 patent is evidence of particularly egregious conduct that tips the equities in Ecolochem's favor. See Aukerman, 960 F.2d at 1033 ("A patentee may also defeat a laches defense if the infringer 'has engaged in particularly egregious conduct which would change the equities significantly in plaintiff's favor.' [ ] Conscious copying may be such a factor weighing against the defendant, whereas ignorance or a good faith belief in the merits of a defense may tilt matters in its favor.") (citations omitted).

166. Accordingly, Ecolochem's delay of less than six years is justified, and Edison cannot prevail on a defense of laches.

VIII. Shop Right and Estoppel.

167. Although the Pre-Trial Conference Order presented questions regarding Edison's shop right defense and Edison's estoppel defense as issues for trial, Edison abandoned these defenses by failing to argue shop right or estoppel at trial or in post-trial briefing. Even if Edison had pursued these two affirmative defenses neither the above material facts nor the evidence would support such defenses.

CONCLUSION

168. Because claims 1, 3-13, 15, 17, 18 and 20 of the '411 patent are invalid under 35 U.S.C. § 103 (obviousness) and claims 1, 4, 7, 8, 9, 10, 11, 12 and 20 are invalid under 35 U.S.C. § 102 (anticipation), the Court orders that judgment be entered in favor of defendant Edison. Edison shall have its costs of suit as allowed by law. Judgment shall be entered forthwith.

IT IS SO ORDERED.

Appendix C

APPENDIX C

UNITED STATES COURT OF APPEALS,
Federal Circuit

ECOLOCHEM, INC.,
Plaintiff-Appellant,
v.
SOUTHERN CALIFORNIA EDISON COMPANY,
Defendant-Appellee.

Decided June 5, 1996.
Rehearing Denied; Suggestion for Rehearing In Banc Declined July 30, 1996.

Before NEWMAN, MICHEL and CLEVENGERS, Circuit Judges.

MICHEL, Circuit Judge.

Decision

Ecolochem, Inc. (Ecolochem) appeals the summary judgment of the U.S. District Court for the Central District of California, No. CV 92-3436 RG, finding claims 1, 2, 5 and 6 of U.S. Patent No. 4,556,492 (the '492 patent) anticipated, and holding claims 7 and 10 of the '492 patent and claim 20 of U.S. Patent No. 4,818,411 (the '411 patent) obvious. The appeal was submitted for decision after oral argument on December 7, 1995. We affirm the findings of anticipation and the conclusions of obviousness of claims 7 and 10 of the '492 patent, but reverse the conclusion of obviousness of claim 20 of the '411 patent and remand for further proceedings.

I. Background

Ecolochem combined the Houghton process with an ion exchange resin to remove excess hydrazine and carbon contaminants and was awarded two patents based on this invention, the '492 patent and the '411 patent (a continua-

tion of the '492 patent application). As prior art, the examiner cited references to applications of the Houghton process and the known use of hydrazine to deoxygenate liquid. In addition, with respect to the '411 patent, the examiner cited references, including Akol'zin, that teach the use of filters and ion exchange resins to remove liquid contaminants. Claim 1 of the '492 patent reads:

1. a deoxygenation process comprising a first step of adding hydrazine to a liquid containing dissolved oxygen, a second step of passing said liquid through a bed of activated carbon to catalyze a reaction between said dissolved oxygen and said hydrazine whereby an amount of dissolved carbon contaminants are added to said liquid, and a third step of passing said liquid through an ion exchange resin selected from the group consisting of mixed bed resin and cation resin to remove at least said dissolved contaminants.

(Claims 2, 5, and 6 are dependent on independent claim 1; claim 7 is dependent on claim 6; claim 10 is dependent on claim 9 which is dependent on independent claim 8.) Claim 1 recites three basic steps: 1) adding hydrazine to a liquid containing dissolved oxygen, 2) catalyzing the reaction between the dissolved oxygen and the hydrazine using activated carbon, and 3) removing dissolved carbon contaminants with an ion exchange resin. Claim 2 adds a filtration step to remove undissolved carbon contaminants; claim 5 recites the additional removal of unreacted hydrazine through the ion exchange resin; claim 6 limits the liquid of claim 1 to water; claim 8 is similar to claim 1 but requires the removal of excess hydrazine in the third step, not the dissolved carbon contaminants; and claims 7 and 10 add a final step of circulating the deoxygenated water at elevated temperature conditions in a power generating apparatus. Claim 20 of the '411 patent is similar to claim 1 of the '492 patent but omits the first step of the process, taking into account that hydrazine may already be present, and claims

the removal of dissolved carbon contaminants with both cation and anion exchange resins in series. On Southern California Edison Co.'s (Edison) motion for summary judgment, the district court found that claims 1, 2, 5 and 6 of the 492 patent are anticipated by Demmitt, a reference not considered by the examiner during prosection of the application leading to the issuance of the patents in suit, and held that, in light of Demmitt, claims 7 and 10 of the '492 patent and claim 20 of the '411 patent are obvious under 35 U.S.C. § 103.[1] Ecolochem appeals from the judgment based on these findings and conclusions which it challenges.

II. Standard of Review

We review the district court's grant of summary judgment *de novo*, resolving all doubts respecting the presence or absence of genuine factual issues in the nonmovant's favor. *Bell Communications Research, Inc. v. Vitalink Communications Corp.*, 55 F.3d 615, 619, 34 USPQ 2d 1816, 1819 (Fed.Cir.1995). Proper claim construction is a question of law which we review de novo. *Markman v. Westview Instruments, Inc.* 52 F.3d 967, 979, 34 USPQ2d 1321, 1329 (Fed.Cir.1995) (in banc), aff'd, 116 S.Ct. 1384 (1996).

III. Anticipation

It is undisputed that the Demmitt reference discloses an application of the Houghton process followed by the use of a cation exchange resin to remove hydrazine from the liquid. The reference does not disclose that carbon contaminants are added to the liquid by the Houghton process, nor does it indicate the desirability of removing those dissolved carbon contaminants. By its very nature, however, the cation resin removes cationic dissolved carbon contaminants. Further-

[1] Claims 8 and 9 of the '492 patent and claim 21 of the '411 patent were also held anticipated, but these findings are not being appealed.

more, it is agreed by the parties that most, if not all, carbon sources used in the Houghton process would leach anionic as well as cationic contaminants. Since anticipation is shown where each and every limitation of the claimed invention is found in a single prior art reference, *In re Donohue,* 766 F.2d 531, 534, 226 USPQ 619, 621 (Fed.Cir.1985), Demmitt anticipates claim 1 if that claim requires only the removal of dissolved cationic carbon contaminants, rather than all of the dissolved carbon contaminants, both cationic and anionic.

A claim is construed by looking at the language of the claim, other claims in the patent, the specification and, where in evidence, the prosecution history. *Markman,* 52 F.3d at 979, 34 USPQ2d at 1329. Claim 1 recites a "deoxygenation process comprising a first step of adding hydrazine . . . a second step . . . [where] carbon contaminants are added . . . and a third step of passing said liquid through an ion exchange resin selected from the group consisting of mixed bed resin and cation resin to remove at least said dissolved contaminants." Ecolochem argues that it is clear from the language of the claim itself, the specification, and the prosecution history of the patent that claim 1 recites a process including a limitation that all dissolved carbon contaminants are to be removed by the ion exchange resin.

Analyzing the language of the claim, we observe that step three of claim 1 is written in the alternative using the Markush format. By claiming a Markush group, Ecolochem has indicated that, for the purpose of claim validity, the members of the claimed group are functionally equivalent. Thus, if utilizing one element of the group is anticipated or obvious, the patentee is precluded from arguing that the claim is valid. *See In re Skoll,* 523 F.2d 1392, 1397, 187 USPQ 481, 484-85(CCPA 1975). Accordingly, if either alternative in the Markush group of step three, *i.e.*, employ-

ing a cation resin or a mixed bed resin, is anticipated, the entire claim is anticipated.

Demmitt clearly discloses the use of the Houghton process on oxygenated water followed by use of a cation exchange resin. As discussed above, Demmitt meets all the limitations of one of the claimed alternatives in claim 1 of the '492 patent (*i.e.*, using a cation exchange resin to remove dissolved contaminants). Accordingly, it would appear that claim 1 is anticipated by Demmitt.

Ecolochem argues, however, that, despite the recitation of a cation exchange resin as an element of the Markush group, there is a limitation in the claim requiring that all dissolved carbon contaminants be removed. This result can be accomplished, Ecolochem claims, by the use of a mixed bed resin or by the use of a cation resin in combination with an anion resin, and since claim 1 is written using the open-ended term "comprising," the claim should be construed to include the use of additional elements, *i.e.*, addition of an anion resin to follow the cation resin of the second alternative. Placement of "comprising" before recitation of steps, however, results in a "comprising" claim that would cover a process that includes additional steps, not one that uses an additional unrecited element for accomplishing a claimed step. *See Moleculon Research Corp. v. CBS, Inc.*, 793 F.2d 1261, 1271, 229 USPQ 805, 812 (Fed.Cir.1986), cert. denied, 479 U.S. 1030 (1987) ("While a transitional term such as 'comprising' or, as in the present case, 'which comprises,' does not exclude additional unrecited . . . steps . . . we conclude that the transitional phrase does not . . . affect the scope of the particular structure recited within the method claim's steps.") Thus, all the claim requires, in step three, is that either a mixed bed resin or a cation exchange resin be used *exclusively* to achieve the stated goal of removing dissolved carbon contaminants added in step two. In sum, a patentee may not import additional limitations into the steps

of a process claim merely by using the word "comprising" in the claim preamble. Accordingly, claim 1 is anticipated by Demmitt.[2]

Because Demmitt clearly discloses the use of water as the liquid to deoxygenate and that the cation exchange resin can be used to remove excess hydrazine, claims 5 and 6 of the '492 patent are anticipated by Demmitt as well. It is unclear

---

[2]The dissent asserts that "anticipation requires that the patented invention was previously known and is described in a single reference." Dissent at 1. The test for anticipation, however, is not a literal word for word comparison between the prior art and the commercial embodiment of the patentee's invention; the test is whether "each and every element as *set forth in the claim is* found, either expressly or inherently described, in a single prior art reference." *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1570, 7 USPQ2d 1057, 1064 (Fed.Cir.1988) (emphasis added); *Glaverbel Societe Anonyme v. Northlake Marketing & Supply, Inc.*, 45 F.3d 1550, 1554, 33 USPQ2d 1496, 1498 (Fed. Cir.1995) ("the claimed process, including each step thereof, must have been described or embodied, either expressly or inherently, in a single reference.") (Newman, J.) (emphasis added); *Standard Havens Prods., Inc. v. Gecor Indus., Inc.*, 953 F.2d 1360, 1369, 21 USPQ2d 1321, 1328 (Fed.Cir.1991) ("An anticipation reference, however, need not duplicate word for word what is in the claims. Anticipation can occur when a claimed limitation is 'inherent' or otherwise implicit in the relevant reference."). As previously discussed, the cation exchange resin disclosed by Demmitt would inherently remove cationic dissolved contaminants, and the claim, as written, requires no more than the removal of those cationic dissolved contaminants. Although there is support in the '492 patent specification for a claim that would require the removal of all dissolved contaminants, including anionic contaminants, the applicant did not draft such a claim for the '492 patent. In fact, he did with claim 20 of the '411 patent. See discussion on obviousness *infra*.

Although we construe limitations narrowly to save the validity of patents, we are precluded from rewriting the patent claim to include unclaimed limitations even where the specification contains adequate support thereof. *See, e.g., Becton Dickinson & Co. v. C.R. Bard, Inc.*, 922 F.2d 792, 799 n. 6, 17 USPQ2d 1092, 1102 n. 6 (Fed.Cir.1990) ("Nothing in any precedent permits judicial redrafting of claims.").

why claim 2, which also calls for the removal of undissolved contaminants, was found to be anticipated by Demmitt. In any event, because Ecolochem fails to distinguish claim 2 from claim 1 for purposes of anticipation, we also affirm the finding on summary judgment that, on the undisputed facts, Demmitt anticipates claim 2.[3]

IV. Obviousness

A. Claims 7 and 10 of the '492 Patent

The district court held claims 7 and 10 of the '492 patent obvious in light of the prior art. Claim 7 is dependent on claim 6, held to be anticipated by Demmitt, and claim 10 is dependent on claim 9, admitted by Ecolochem to be anticipated by Demmitt. Both claims add a final step of circulating the deoxygenated water at the conditions of elevated temperature in a power generating apparatus. The Demmitt reference specifically states that the tests he was conducting were on a system that "would be useful in high temperature reactors." In addition, the 1982 Bechtel reference (Bechtel) discusses the benefits of using carbon catalyzed hydrazine in a PWR steam generator. Accordingly, the district court was correct in concluding that claims 7 and 10 would have been

---

[3]The dissent states that Ecolochem distinguishes claim 2 from claim 1 of the '492 patent for purposes of anticipation by stating that " 'claim 2 requires the presence of a fourth filtration step to remove undissolved active carbon contaminants.' " Dissent at 2 (emphasis in original). This statement was made in the background section of Ecolochem's brief for the purpose of listing the claims in suit. In the argument section of its brief, however, Ecolochem asserts that "[t]he anticipation issues center on the interpretation of claim 1 of the '492 patent" and does not distinguish claim 2 as being patentably distinct from claim 1.

obvious under 35 U.S.C. § 103 in light of Demmitt and Bechtel.[4]

---

[4]The dissent characterizes the majority opinion as holding claims 7 and 10 obvious because the "independent claims from which they depend are 'anticipated,' " thereby accusing the majority of using a patent's claims as "prior art against itself." Dissent at 3. This is inaccurate. Claims 7 and 10 are held obvious in light of Demmitt and Bechtel because they claim a recommended use of the process employed in Demmitt.

In addition, the dissent points out that the process commercially employed by Ecolochem to deoxygenate liquid in a power plant arguably fulfilled a long felt need, was a commercial success, and might not be obvious in light of Demmitt. Dissent at 3-4. However, as discussed *supra*, claims 7 and 10 of the '492 patent fail to recite features employed by Ecolochem in its commercial embodiment. Neither dependent claims 7 and 10, nor independent claims 1 and 8 upon which they respectively depend, require the use of both anionic and cationic resins to remove all dissolved carbon contaminants as employed in Ecolochem's commercial embodiment which forms the basis of Ecolochem's evidence of commercial success. Secondary considerations are only legally relevant where they relate to the patented process, not unclaimed features of a commercial embodiment. *In re Vamco Machine and Tool, Inc.*, 752 F.2d 1564, 1577, 224 USPQ 617, 625 (Fed.Cir.1985) (court found "no 'secondary considerations' in [that] case having a bearing on the legal issue of the obviousness of the invention" where affidavits extolled the virtues of a commercial embodiment that was different from the claimed invention).

Claims 7 and 10 of the '492 patent recite nothing more than the process taught in Demmitt plus a final step of circulating the deoxygenated water at the conditions of elevated temperature in a power generating apparatus. We agree with the dissent that the proper test for obviousness is not whether a judge sitting today would find the invention obvious. However, it is not "hindsight" to hold as we do that this invention would have been obvious at the time of the application to the ordinary artisan in light of the clear teachings of the prior art and the meaning of the claim as properly interpreted. The environment claimed in claims 7 and 10 is clearly suggested by Demmitt as well as the Bechtel reference. *See text supra.*

B. Claim 20 of the '411 Patent

The district court also concluded that claim 20 of the '411 patent would have been obvious in light of the other prior art read in conjunction with Demmitt. Claim 20 of the '411 patent recites the same process as claim 1 of the '492 patent except that it begins with hydrazine already in the liquid and it specifies the use of a cation resin in series with an anion resin to remove carbon contaminants. As Demmitt discloses adding the hydrazine, starting with hydrazine already in the liquid is inherently taught by Demmitt. Claim 20 of the '411 patent, as opposed to claim 1 of the '492 patent, however, requires use of both cationic and anionic resins and can be read to require the removal of all dissolved carbon contaminants.

In a prior action, the broader '492 patent had been held not to be invalid for obviousness. *Ecolochem, Inc. v. Mobil Water Tech. Co.*, 690 F.Supp. 778 (E.D.Ark.1988), *aff'd*, 871 F.2d 1096 (Fed.Cir.1989) (table) (hereinafter *Mobil Water)*. In the present case, the district court found that although prior art before the court in *Mobile Water* did not offer any suggestion to combine the Houghton process with ion resin filtration of contaminants, the Demmitt reference, not before the Arkansas district court, clearly did so. The court below then found that "Demmitt suggests that adding anion exchange resin to the end of the Houghton process will remove impurities in the effluent."

The district court clearly mischaracterized the import of Demmitt as a prior art reference for the determination of obviousness of claim 20. Demmitt, though anticipating claims 1, 2, 5 and 6 of the '492 patent, did not disclose the removal of carbon contaminants with an ion exchange resin. The only real discussion of the resin is in connection with a formula showing how hydrazine, not dissolved carbon contaminants, can be removed from the liquid. The only "suggestion" made by Demmitt is that it would remove

hydrazine, and not other "impurities in the effluent" as stated by the district court. Furthermore, the Akol'zin reference, which does disclose the Houghton process in combination with an ion exchange filter, was cited on the front page of the '411 patent and was thus before the patent examiner, as well as the court in *Mobil Water*. 690 F.Supp. at 782. This reference discloses a process for using hydrazine to deoxygenate a liquid and then filtering the liquid through two filters, "the first containing activated carbon and the second containing an ion exchanger AV-17." Like Demmitt, Akol'zin uses an ion exchange resin to filter the effluent. However, as with Demmitt, the reference "does not teach the use of a mixed bed resin to remove ionic impurities introduced by leaching from the activated carbon." *Id.* Demmitt teaches no more than Akol'zin and is, therefore, merely cumulative.

Despite the district court's mischaracterization of the importance of Demmitt, Ecolochem concedes that there is a "prima facie case of obviousness before Demmitt and there remains one after." However, Ecolochem argues that the secondary considerations, in this case, could rebut the prima facie case and that the district court wrongly failed to consider its evidence of secondary considerations and conclude that the evidence raised a genuine issue of fact requiring trial. We agree.

The district court asserted that "[s]econdary considerations carry little weight where a critical prior art reference has long been neglected," citing *Graham v. John Deere Co.* 383 U.S. 1, 36 (1966). Upon finding that Demmitt was such a critical prior art reference, the district court discounted any effect of the secondary considerations. Contrary to the actions of the district court in this case, however, the court in *Graham* fully evaluated the secondary consideration but found that in those circumstances, the secondary factors failed to "tip the scales of patentability." *Id.* It is not the law

that secondary considerations carry little weight, just that prior art may affect the weight of the evidence of those considerations and vice versa. In addition, as discussed above, Demmitt, being merely cumulative, is not a "critical" but an uncited ("long neglected") reference. Hence, it adds nothing to the prior art before the patent examiner and the court in *Mobile Water.*

Ecolochem has put forth a large quantity of evidence of secondary considerations to show that the process of its invention was not obvious. Included was evidence: that there was a long-felt, unsolved need in the industry; that many tried but failed to find a solution; that various references taught away from the invention as they warned against the Houghton process because of the carbon contaminants; that customers have been satisfied with Ecolochem's process; that Ecolochem's invention has been widely discussed and favorably received; that Ecolochem's process has had a large impact on the industry; that others have tried to copy Ecolochem's process; and that Ecolochem has had great commercial success due to the patented invention. These are material facts for determining obviousness which, if found by the fact-finder in favor of Ecolochem, could have tipped the scales to validity as in the *Mobile Water* court.

The district court did not make any findings with respect to the credibility or weight of Ecolochem's evidence regarding secondary considerations, and it would have been improper to do so on summary judgment. Edison, on its part, has put forth evidence to refute Ecolochem's evidence regarding secondary considerations. Accordingly, there are genuine issues of material fact as to secondary considerations that can only be resolved at trial. Only then will the district court be in a position to assess the prior art in light of the secondary considerations to determine whether the prima facie case of obviousness has been overcome.

V. Conclusion

For the foregoing reasons, the trial court's finding of anticipation of claims 1, 2, 5 and 6 of the '492 patent by Demmitt and its holding of obviousness of claims 7 and 10 of the '492 patent, in light of Demmitt, are affirmed, but the trial court's holding of obviousness of claim 20 of the '411 patent is reversed, and the case is remanded for trial on validity and infringement as to claim 20. The judgment of the U.S. District Court for the Central District of California regarding the invalidity of U.S. Patent Nos. 4,556,492 and 4,818,411 is thus affirmed-in-part, reversed-in-part, and remanded for further proceedings not inconsistent with this opinion.

Costs

Each party to bear its own costs.

NEWMAN, Circuit Judge, concurring in part and dissenting in part.

I write separately to explain why I do not share the view of the panel majority that the '492 patent is invalid.

Anticipation

A finding of anticipation requires that the patented invention was previously known and is described in a single reference. However, my colleagues on this panel have not correctly perceived the technological substance of the Demmitt reference, on which they rely for anticipation. Demmitt reported a scientific study of the Houghton process, whereby he measured the amount of residual hydrazine by taking a sample of the aqueous stream, passing this sample through a cation exchange resin to remove materials that interfere with the measurement of hydrazine, and then measuring the hydrazine content of the sample. This is not the same as the Ecolochem deoxygenation process, wherein carbon catalyst-sourced impurities are removed, as a step in power plant and

reactor water deoxygenation, by use of a mixed- or cation-exchange resin.

"Anticipation" means lack of novelty. The Houghton process had languished in disuse until Ecolochem solved the serious problem caused by the carbon-source impurities resulting from that process. Demmitt did not treat or solve that problem. Whatever the relation between Demmitt and the claimed invention, it is not "anticipation,"[5] for Demmitt does not disclose the claimed invention.

The Houghton process for removal of dissolved oxygen has long been known, but until Ecolochem's invention disclosed in the '492 patent, the utility of the Houghton process was limited because of the contaminants leached into the water from the carbon catalyst. The publications and other evidence of record show that this problem with the Houghton process was long-standing, and had impeded significant utilization of that process. The record shows that the Ecolochem invention was a widely recognized breakthrough in water purification processes. Demmitt's work twenty-three years earlier was unrelated to the removal of carbon-leached contaminants, as required by claim 1 of the '492 patent.

---

[5] I do not say that anticipation requires "a literal word for word comparison," as the panel majority states. I do say that anticipation requires that the same invention be described in a single prior art reference. RCA Corp. v. Applied Digital Data Systems, Inc., 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed.Cir.) ("Anticipation is established only when a single prior art reference discloses, expressly or under principles of inherency, each and every element of a claimed invention."), cert. dismissed sub nom. Hazeltine Corp. v. RCA Corp., 468 U.S. 1228 (1984). The Ecolochem claims require treatment of the entire reactor stream, including removing all of the carbon-source contaminants. Demmitt's purification of a small titer for analytical purposes does not meet that criterion, explicitly or inherently.

Nor can the dependent claims be anticipated by a reference that does not describe the added limitations in these claims. Indeed, the panel majority appears to recognize that claim 2 is not anticipated, but casually wipes out claim 2 with the statement that Ecolochem did not distinguish it. That is incorrect, for Ecolochem argued that "claim 2 requires the presence of a fourth filtration step to remove undissolved activated carbon contaminants" (emphasis in original). That step is not even remotely shown, or inherently present, in Demmitt. On no interpretation can Demmitt be found to anticipate claim 2. The panel majority holds that because Ecolochem distinguished claim 2 in only one part of its appellate brief, while stating in another part of the brief that claim 1 presents the central issue, then claim 2 is deemed abandoned on appeal. Claim 2 was not abandoned. It was retained, appealed, and distinguished as appropriate to its subject matter.

Obviousness

The panel majority holds that claims 7 and 10 of the '492 patent would have been obvious because the independent claims from which they depend are "anticipated" by Demmitt. Even if these claims were deemed to be anticipated — as they are not — this ground of "obviousness" is incorrect in law. 35 U.S.C. § 103 requires that obviousness be determined for the invention as a whole, in light of the prior art, not in light of other claims of the same patent. A patent's claims are not prior art against itself. Further, while Ecolochem did not appeal the district court's decision as to all of the claims, that is not an admission as to the non-appealed subject matter. The narrowing of issues on appeal is to be commended, not punished.

Obviousness is determined as of the time the invention was made. The record documents the extensive efforts of others, and the complex procedures that were used by

others, to remove dissolved oxygen. Ecolochem cites an early estimate that corrosion-caused replacement and repair costs ranged from $50-100 million per year in the United States. J.H. Metcalf, Inhibition and Corrosion Control Practices for Boiler Waters, in CORROSION INHIBITORS 196 (C.C. Nathan, ed.1973). The simple solution discovered by Ecolochem escaped all who came before, and was rapidly embraced and copied by those who came after.

The district court found that there was long-felt need, commercial success, and copying of the Ecolochem invention. Engineers directly involved in this field stated that the Ecolochem process had "unexpected" potential. The record shows the contemporaneous acclaim by persons and even industries that were concerned with the problem of large-scale deoxygenation of water. Indeed, the value of the Ecolochem invention transcended the power plant field; for example, a report praised the Ecolochem process as meeting the water deoxygenation needs of the pulp and paper industry.

It is in this practical milieu that the patent system exists, not the litigation-induced indulgence in hindsight. I can not agree with the panel majority that it would have been both known and obvious to engineers in this field to do what they did not do, to expect what they did not expect, in order to adapt the Houghton process to practical deoxygenation. Demmitt, Bechtel, and others rejected the Houghton process in face of the very problem that Ecolochem showed them how to solve. This is a classical example of misplaced judicial expertise, whereby a breakthrough that was lauded at the time and was accompanied by contemporaneous surprise at how it was accomplished, is now found by judges to have been obvious all along.

Statute and precedent require that obviousness be determined from the viewpoint of a person of ordinary skill at the time the invention was made. Insights to this determination

are provided by the record in this case, which shows: (1) Demmitt's rejection of the Houghton process for use at Hanford; (2) competitors' work with a palladium catalyst in order to avoid the problem of impurities from the carbon catalyst; (3) the failure of Bechtel, an engineering giant in this field, and of others, to solve the problem solved by Ecolochem; and of course (4) California Edison's insistence on continuing to use the Ecolochem process. It is not irrelevant that one of California Edison's engineers stated that "[Ecolochem] saved our ass" and "made heroes out of [names]."

That Ecolochem's solution to the problem of deoxygenation of ambient water in power plants and reactors is retrospectively simple is not the test of the law. Although the panel majority recognizes the important role of objective considerations in its reversal of the summary judgment with respect to the '411 patent, these considerations are also applicable to the '492 patent. The panel majority states at n. 4 that the evidence of secondary considerations can not be considered, stating that the claims "fail to recite features employed by Ecolochem in its commercial embodiment." That is incorrect. The affidavits of commercial success and long-felt need relate to the claimed invention. They are powerful evidence in support of the conclusion that the invention was not obvious to a person of ordinary skill.

Thus I must, respectfully, dissent from the panel majority's decision and its analysis of fact and law concerning the '492 patent.

Additional Concerns

I briefly state some additional concerns with the panel majority's discussion of the legal premises of its decision. The majority states that it is no longer necessary to weigh objective evidence such as commercial success along with the other Graham factors; but instead sets this evidence in

opposition to the other Graham factors, instructing the district court "to assess the prior art in light of the secondary considerations." That is an incorrect methodology. All evidence must be considered and weighed together, giving each aspect the probative value and credibility that its substance warrants, in determining whether the presumption of validity has been overcome. The contemporaneous views of the engineers who use and understand the technology must be considered along with the prior art, for these views place the invention in the proper context for adjudication.

I do not endorse the rules of claim construction proposed by the majority, for example with respect to the word "comprising." A patentee is not required to place in the claims every detail or step of the total process. It is incorrect to state that Ecolochem's evidence of commercial success does not relate to the patented process but to "unclaimed features," for it is the patented process that is commercially successful. Further, the mixed resin of claim 1 is an anionic/cationic resin.

Appendix D

APPENDIX D

No. CV 92-3436 RG (JGX).

UNITED STATES DISTRICT COURT,
Central District of California

ECOLOCHEM, INC.,
Plaintiff,
v.
SOUTHERN CALIFORNIA EDISON COMPANY,
Defendant.

Sept. 1,1994.

Memorandum and Order Regarding Edison's Motions for Summary Judgment

GADBOIS, District Judge.

In June 1992, Ecolochem, Inc. ("Ecolochem") sued Southern California Edison Company ("Edison") for patent infringement. Edison moved for partial summary judgment, arguing that it does not infringe as a matter of law, and that some of Ecolochem's claims are anticipated by, or obvious in light of, a prior publication.[1]

---

[1] *Glossary of Essential Terms*

Ion: In solutions, an electrically charged atom or group of atoms.

Anion: An ion having a negative charge.

Cation: An ion having a positive charge.

Cation Exchange Resin: A resin which, when brought in contact with liquid containing cation contaminants, removes them. Mixed Bed: A mixture of strong acid cation and strong base anion resins. A mixed bed resin removes both cationic and anionic carbon contaminants from liquids with which it comes in contact.

Stoichiometric: Involving substances that are in the exact proportions required for a given reaction.

I. Background

A. *Ecolochem's Patents.*

Ecolochem owns U.S. Patents No. 4,556,492 ('492 Patent) and No. 4,818,411 ('411 Patent). These patents describe similar deoxygenation processes which include:

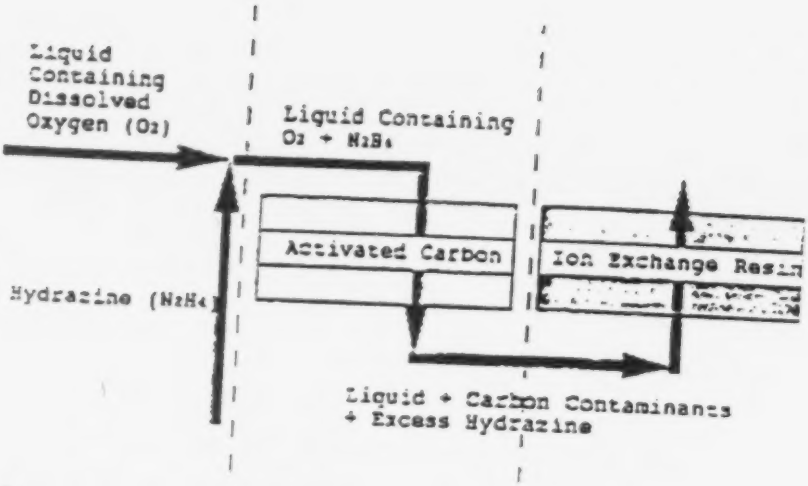
> adding hydrazine [N2H4] to a liquid containing dissolved oxygen [02], passing the liquid through a bed of activated carbon to catalyze a reaction between the dissolved oxygen and hydrazine [N2H4 + 02-> 2H20 + N2] whereby carbon contaminants are added to the liquid, and removing the contaminants. In another embodiment, unreacted hydrazine that remains in the liquid following the catalysis is removed by passing the liquid through an ion exchange resin.

'492 Patent Abstract. Figure 1 illustrates the three main steps of this process.

[SEE NEXT PAGE]

FIGURE 1:
ONE PREFERRED EMBODIMENT OF
THE CLAIMED INVENTION

The patents acknowledge that step 1, the use of hydrazine to eliminate oxygen, is not in and of itself new — "[i]n prior art deoxygenation processes, hydrazine has been used as a strong reducing agent to prevent corrosion and other problems associated with oxygenated water." '411 patent, column 1. Step 2, using activated carbon as a catalyst, is not new either — "[i]t is known that the reaction of hydrazine with dissolved oxygen can be catalyzed by passing the hydrazine and water mixture through a bed of activated carbon." *Id.*



STEP 1:
Hydrazine (N_2H_4) added to Liquid Containing Dissolved Oxygen (O_2).

STEP 2:
Catalysis of O_2 - N_2H_4 Reaction with Activated Carbon. Carbon Contaminants Added; Excess Hydrazine Remains.

STEP 3:
Removal of Dissolved Carbon Contaminants and Excess Hydrazine with Mixed Bed or Cation Exchange Resin.

FIGURE 1:
ONE PREFERRED EMBODIMENT OF THE CLAIMED INVENTION

BEST AVAILABLE COPY

According to Ecolochem, these two steps were imperfect, however:

> [one] disadvantage of the catalyzed deoxygenation processes of the prior art arises

'411 columns 1-2. Thus, Ecolochem's patent claims a third step — passing the deoxygenated liquid through an ion exchange resin to remove carbon contaminants and excess hydrazine.

B. *The Demmitt Reference.*

In 1960, more than twenty years before the '492 and '411 applications were filed,[2] T.F. Demmitt wrote a report on a similar deoxygenation process, *Preliminary Report on the Use of Activated Carbon As A Catalyst for the Dissolved Oxygen — Aqueous hydrazine Reaction* (1960) ("Demmitt reference"). Demmitt was concerned that "the[hydrazine/oxygen]reaction proceeds rather slowly in low-temperature systems", and wondered whether activated carbon would hasten the process.

To determine if his experiment was a success, Demmitt measured the oxygen levels in the effluent using the Winkler method. However, because hydrazine interferes with this technique, Demmitt removed the hydrazine by adding a column of acid-regenerated cation resin. Although Demmitt did not discuss carbon contaminants, his cation resin removed at least some of them. Figure 2 shows Demmitt's experimental system in schematic form.

[SEE NEXT PAGE]

FIGURE 2: DEMMITT REFERENCE

[2] The '492 application was filed December 16, 1983. The '411 application was filed on July 26, 1985 as a continuation of '492.

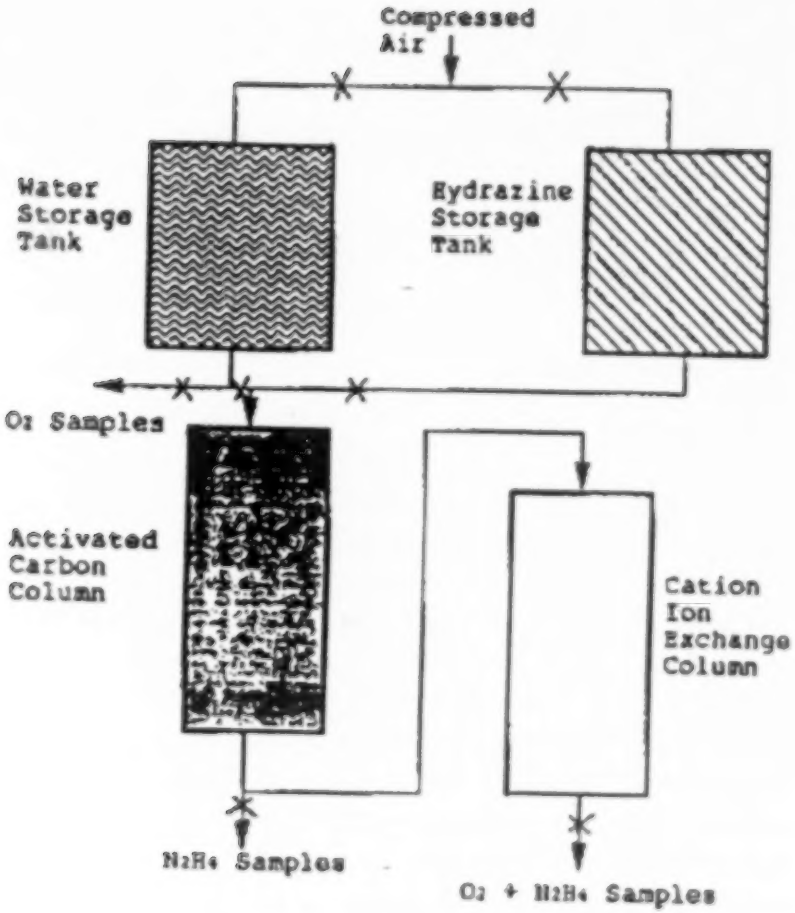


FIGURE 2:
Demmitt Reference

C. *The Mobile Water Case.*

In 1988, Ecolochem sued Mobile Water Technology Co. ("Mobile Water"), alleging that Mobile Water had infringed the '492 patent. Mobile Water countered that Ecolochem's invention was obvious, but did not, however, provide the court with the Demmitt reference. After a bench trial, Judge Henley found the '492 patent valid and non-obvious. *Ecolochem, Inc. v. Mobile Water Technology Co.*, 690 F.Supp. 778 (E.D.Ark.1988), *aff'd* 871 F.2d 1096 (Fed.Cir.1989).

D. *Edison's Process.*

Defendant Southern California Edison Company ("Edison") runs the San Onofre Nuclear Generating Station ("SONGS"). SONGS contains three nuclear reactors, each of which contains two water circulation systems. The primary water circulation system removes heat from the nuclear reactor. The heat from the primary system boils water in a secondary system, turning it into steam. The steam rotates a turbine, which produces electricity. The steam then condenses and recirculates through the secondary system. Because the secondary system loses approximately 1% of its water each cycle, SONGS requires make-up water. Impurities in water circulated through the secondary system can damage steam generators, turbines, and pipes, however, so Edison passes the make-up water through the high-flow make-up demineralizer ("HFMUD"). HFMUD passes the make-up water through a strong acid cation resin bed, a predominantly weak base anion resin bed, an activated carbon bed, a second strong acid cation resin bed, a strong base anion bed, and, finally, a vacuum deareator.

This process removes suspended, undissolved solids and dissolved impurities, including salt, mineral ions, organic chemicals, and oxygen.

Ecolochem maintains that Edison's HFMUD infringes '492 claims 1, 2, 5, 6, 7, 8, 9, 10, 15, 16, 17, and 18, and '411 claims 1, 3, 4, 7, 8, 9, 10, 11, 13, 15, 17, 20, and 21. On April 12, 1994, this Court held that the Demmitt reference anticipated '492 claims 1, 5, 6, 8, and 9, and '411 claim 21. Edison now seeks partial summary judgment of non-infringement and patent invalidity. This opinion amends this Court's previous order regarding anticipation, denies Edison's motion for summary judgment of non-infringement, and grants Edison's motion for summary judgment of invalidity due to obviousness.[3]

II. *Analysis*

A. *Motion for Summary Judgment of Non-infringement*

In a patent case, as in any other, summary judgment is appropriate where there are no genuine issues as to any material fact and the movant is entitled to judgment as a matter of law. *Conroy v. Reebok Int'l, Ltd.*, 14 F.3d 1570, 1575 (Fed.Cir.1994); *Johnston v. IVAC Corp.*, 885 F.2d 1574, 1577 (Fed.Cir.1989); F.R.Civ.P. 56(c). To resolve a motion for summary judgment of non-infringement, courts must first determine the scope of the claims, a question of law. *In re Donaldson Co., Inc.*, 16 F.3d 1189, 1192 (Fed.Cir.1994); *Unique Concepts, Inc. v. Brown*, 939 F.2d 1558, 1561 (Fed.Cir.1991); *Mannesmann Demag Corp. v. Engineered Metal Products Co.*, 793 F.2d 1279, 1283 (Fed.Cir.1986). Next, courts must determine whether any reasonable trier of fact could conclude that the accused process falls within the scope of the claims. *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 1116 (Fed.Cir.1985) (en banc). In doing so, "the district court must view the evidence in a light most favorable to the

---

[3]This Court has jurisdiction under 28 U.S.C. §§ 1331, 1338(a).

nonmovant and draw all reasonable inferences in its favor." Id.

1. *CLAIM INTERPRETATION: "Deoxygenation Process".*

Ecolochem's patents describe a "deoxygenation process." Edison contends that a deoxygenation process *eliminates,* not merely reduces, oxygen from a liquid, and that the patented process therefore requires more than a stoichiometric amount of hydrazine. Ecolochem disagrees, arguing that the claims do not require *complete* oxygen elimination, and thus do not require more than a stoichiometric amount of hydrazine. To determine which party is correct, this Court reviews (a) the words' ordinary meaning, (b) the patent specification, (c) the other claims, (d) the patent's file history, and (e) expert testimony. Although claim interpretation is a question of law, if "the meaning of a term of art in the claims is disputed and extrinsic evidence is needed to explain the meaning, construction of the claims could be left to a jury." *McGill Inc. v. John Zink Co.,* 736 F.2d 666, 672 (Fed.Cir.), *cert. denied,* 469 U.S. 1037, 105 S.Ct. 514, 83 L.Ed.2d 404 (1984).

(a) *Ordinary Meaning.*

The words of a claim "will be given their ordinary and accustomed meaning, unless it appears that the inventor used them differently." *Envirotech Corp. v. Al George, Inc.,* 730 F.2d 753, 759(Fed.Cir.1984)(quoting *Universal Oil Products Co. v. Globe Oil & Refining Co.,* 137 F.2d 3, 6 (7th Cir. 1943), aff'd, 322 U.S. 471, 64 S.Ct. 1110, 88 L.Ed. 1399 (1944). Ecolochem contends that the ordinary meaning of "deoxygenate" is "to remove oxygen," not necessarily to remove all oxygen. *Webster's Ninth New Collegiate Dictionary* (1990). Ecolochem's expert, James K. Rice, agrees, stating that "the term 'deoxygenation process' as used in the water treatment industry would mean a process that

removes a substantial amount of dissolved oxygen, not necessarily all of it." Rice Decl. ¶13. Citing *Webster's,* Edison argues that "remove" means "get rid of; eliminate" and thus necessarily implies *complete* elimination.

(b) *Specification.*

Courts often use the specification to help define the terms in the claims. *Jonsson v. Stanley Works,* 903 F.2d 812, 819 (Fed.Cir.1990); *D.M.I., Inc. v. Deere & Co.* 755 F.2d 1570, 1574 n.2 (Fed.Cir.1985); *Tandon Corp. v. U.S. Int'l Trade Comm'n,* 831 F.2d 1017, 1024 (Fed.Cir.1987); McGill, 736 F.2d at 674. Although the '411 and '492 specification do not explicitly define "deoxygenation process," several passages suggest that more than a stoichiometric amount of hydrazine is "needed" or "necessary" to practice the invention.[4] See '492 patent col. 4:3-5 (emphasis added) (noting that it is *"necessary . . . to use enough hydrazine* to *completely react* with the dissolved oxygen contained in the liquid."); '411 patent col. 4:6-8. *See also* '492 patent col. 4:5-8; '411 patent col. 4:8-11 ("[I]n the present invention . . . hydrazine in amount of . . . about 10 to 20% more than a stoichiometric amount is needed to completely react with the oxygen."); '492 Patent col. 4:2 8-31 ("[U]nreacted hydrazine is present [after the water exits the carbon bed] because an excess over the stoichiometric amount is beneficially reacted with the liquid, as indicated above."); '411 patent col. 4:31-34. *See Autogiro Co. v. United States,* 384

[4]Ecolochem argues that this Court should give these remarks no weight because the specification does not *explicitly* state that "these claims only cover the use of a greater than stoichiometric amount of hydrazine." An explicit statement is not necessary, however; a specification can *implicitly* suggest that a term has a certain meaning. *See Constant v. Advanced Micro-Devices, Inc.,* 848 F.2d 1560, 1571 (Fed.Cir.), cert. denied, 488 U.S. 892, 109 S.Ct. 228, 102 L.Ed.2d 218 (1988). ("The [specification] text does not implicitly suggest that the words should be interpreted [as plaintiff suggests].").

F.2d 391, 38 (Ct.Claims 1967); *Foster Wheeler Corp. v. Babcock & Wilcox Co.*, 512 F.Supp. 792,800 (S.D.N.Y.1981).

Ecolochem contends that these words do not help define the claims because they fall under the heading "Description of the Preferred Embodiments." As Ecolochem notes, passages in a specification which describe the *preferred* embodiment do not help define the claims. *SRI Int'l*, 775 F.2d at 1122. *See also E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 1433 (Fed.Cir.1988), *cert. denied*, 488 U.S. 986, 109 S.Ct. 542, 102 L.Ed.2d 572 (1988); *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1571 (Fed.Cir.), cert. denied, 488 U.S. 892, 109 S.Ct. 228, 102 L.Ed.2d 218 (1988). The "Abstract", "Background of the Invention", and "Summary of Invention" sections do not suggest Edison's interpretation. Thus, this Court finds the specification somewhat ambiguous, and cannot conclude, with confidence, that the words "necessary" and "needed" refer to the invention as a whole, rather than the preferred embodiment.

(c) *Other Claims.*

"Significant evidence of the scope of a particular claim can be found on review of other claims." *Fromson v. Advance Offset Plate, Inc.*, 720 F.2d 1565, 1570 (Fed.Cir.1983); see also *North American Vaccine, Inc. v. American Cyanamid Co.*, 7 F.3d 1571, 1577 (Fed.Cir.1993); *McGill*, 736 F.2d at 674. Edison notes that several of the claims require removal of excess hydrazine, and argues that excess hydrazine will remain in the system only if one adds more than a stoichiometric amount of hydrazine.

Ecolochem contends that unreacted hydrazine may be present downstream even if one adds less than a stoichiometric amount of hydrazine, but fails to present any evi-

dence supporting this contention.[5] Ecolochem also argues that one cannot expect to always add less than a stoichiometric amount, even if one tries to. Because the influent's oxygen levels may vary and system operators may err, Ecolochem states that even if one attempts to add less than the stoichiometric amount of hydrazine, excess hydrazine may still appear downstream.[6] Such factors, Ecolochem maintains, explain why certain claims require removal of excess hydrazine even though more than the stoichiometric amount of hydrazine is not required. Thus, rather than suggest that deoxygenation means oxygen elimination, claims requiring hydrazine removal may merely recognize that oxygen levels vary, and that the invention might not always be practiced perfectly.

(d) *File History.*

"[A]n invention is construed not only in light of the claims, but also with reference to the file wrapper or prosecution history in the patent office." *Graham v. John Deere Co.*, 383 U.S. 1, 33, 86 S.Ct. 684, 702, 15 L.Ed.2d 545

---

[5] Rice's declaration does not support Ecolochem's position. Rice states that "[f]eeding a less than stoichiometric amount of hydrazine . . . will generally result in substantially complete reaction of the hydrazine." Rice Decl. ¶15. If the hydrazine "substantially complete [ly]" reacts, none would be left downstream. Ecolochem also suggests that "[u]nreacted hydrazine can result from channeling of the activated carbon bed [or] microbial contamination of the carbon" even if less than a stoichiometric amount is used, Opposition at 2, but fails to cite any *evidence* supporting counsel's argument.

[6] As the '492 specification described it:

> The unreacted hydrazine is present because an excess over the stoichiometric amount of hydrazine is beneficially reacted with the liquid. . . . Also, because the dissolved oxygen content of the incoming liquid may vary . . . the amount of unreacted hydrazine will vary when a fixed amount of hydrazine, unresponsive to the varying dissolved oxygen content, is added. '492 Col. 4:28-36.

(1966); see also *Miles Labs., Inc. v. Shandon Inc.*, 997 F.2d 870, 876 (Fed.Cir.1993), cert. denied, 510 U.S. 1100, 114 S.Ct. 943, 127 L.Ed.2d 232(1994); *McGill*, 736 F.2d at 673. As Edison notes, the file wrapper remarks that "up until the time that applicants made this invention, ... while stoichiometrically excessive amounts of hydrazine have been suggested for use in the deoxygenation stage, there has been a clear indication that the amount of hydrazine in the deoxygenated product was unimportant." See '492 File Wrapper at 41, 43. According to Edison, hydrazine appears in the effluent *only* if more than a stoichiometric amount is used. Therefore, Edison contends that this passage implies that more than a stoichiometric amount of hydrazine is required.

Although the file wrapper clearly *suggests* that those practicing the invention will use more than a stoichiometric amount of hydrazine, it does clearly not state that they *must* do so. Moreover, Ecolochem presents testimony that excess hydrazine must be removed not because the invention requires more than a stoichiometric amount, but due to varying oxygen levels and operating errors. *See supra*. Consequently, the file wrapper is not dispositive.

(e) Expert Testimony.

"In a patent case involving complex scientific principles, it is particularly helpful to see how those skilled in the art would interpret the claim." *Moeller v. Ionetics, Inc.*, 794 F.2d 653, 657 (Fed.Cir.1986). See also McGill, 736 F.2d at 675. As noted above, Ecolochem's expert, Rice, contends that the claims do not require more than a stoichiometric amount of hydrazine. Edison does not present expert testimony on the subject.

(f) Claim Construction — Conclusion.

The claims quite clearly *recommend* the use of more than a stoichiometric amount of hydrazine, but this Court cannot determine whether the claims *require* it. If Rice's testimony regarding the common, industry meaning of "deoxygenation process" is correct, Ecolochem's interpretation might, in fact, be correct. At a minimum, because the specification, other claims, and prosecution history are somewhat ambiguous, Rice's declaration creates a genuine issue of material fact.

Summary judgment on claim construction is therefore inappropriate. *See Howes v. Medical Components, Inc.,* 814 F.2d 638, 643 (Fed.Cir.1987) ("If . . . expert testimony is needed to explain a disputed term, . . . an underlying factual question may arise which makes summary judgment improper."); *Moeller,* 794 F.2d at 657; Schneider (USA) Inc. v. C.R. Bard, Inc., 18 U.S.P.Q.2d 1076, 1990 WL 292143 (D.Mass.1990).

2. *INFRINGEMENT*

Because summary judgment is inappropriate on the claim construction issue, Edison is entitled to summary judgment of non-infringement only if no reasonable trier of fact, giving the patents Ecolochem's asserted definition, could conclude that Edison infringes. Edison does not contend that it can make such a showing; thus, Edison's motion for summary judgment of non-infringement is DENIED.

B. *Motion for Summary Judgment of Patent Invalidity*

A patent enjoys a presumption of validity. 35 U.S.C. § 282. Nevertheless, a claim may be held invalid where an alleged infringer proves, by clear and convincing evidence, that a prior art reference anticipates the invention, 35 U.S.C. § 102(b), or renders it obvious, 35 U.S.C. § 103. See, e.g., *Medtronic Inc. v. Intermedics, Inc.,* 799 F.2d 73 4,

741 (Fed.Cir.1986), *cert. denied,* 479 U.S. 1033, 107 S.Ct. 882, 93 L.Ed.2d 836 (1987). This Court is not a "Super Patent Examiner," empowered to second- guess the PTO. *Mobile Water,* 690 F. Supp. at 781 (citing Markey, *On Simplifying Patent Trials,* 116 F.R.D. 369, 375-76 (1987)). Nevertheless, this Court has a special duty to scrutinize cases where relevant references were not presented to the PTO. *See EWP Corp. v. Reliance Universal Inc.,* 755 F.2d 898, 905 (Fed.Cir.), *cert. denied,* 474 U.S. 843, 106 S.Ct. 131, 88 L.Ed.2d 108 (1985) ("[I]n considering [validity] we have no PTO view before us on [validity] in view of those references and appellants' burden of proof under 35 U.S.C. § 282 is more easily carried."); *Jervis B. Webb Co. v. Southern Systems, Inc.,* 742 F.2d 1388, 1392 (Fed.Cir.1984).

1. *ANTICIPATION*

Under 35 U.S.C. § 102(b), a patent is "anticipated" by a prior publication and, therefore invalid if "the invention was . . . described in a printed publication in this or a foreign country . . . more than one year prior to the date of the application for patent in the United States . . . ." An anticipatory reference must (a) be a "printed publication" published more than one year before the filing date of the patent application; and (b) describe the invention clearly enough that one of ordinary skill in the art could make it. *See, e.g., In re Hall,* 781 F.2d 897, 899 (Fed.Cir.1986).

(a) *"Printed Publication" — Was the Demmitt Reference Sufficiently Accessible?*

A reference is a "printed publication" under § 102 (b) if it was "available to the extent that persons interested and ordinarily skilled in the subject matter or art, exercising reasonable diligence, [could] locate it." *In re Wyer,* 655 F.2d 221, 226 (C.C.P.A.1981). *See also Constant,* 848 F.2d at 1568-69; Hall, 781 F.2d at 900. However, Edison need

not show that members of the public actually received the information. *Constant,* 848 F.2d at 1569; *Wyer,* 655 F.2d at 226.

If a publication is kept in a public library or database, the inquiry usually focuses on whether the document has been catalogued and shelved. *In re Cronyn,* 890 F.2d 1158, 1161 (Fed.Cir.1989); *Wyer,* 655 F.2d at 226. For instance, a dissertation written in German and catalogued in a single German university library is sufficiently accessible. *Hall,* 781 F.2d at 899-900. *See also Wyer,* 655 F.2d at 223, 226-27 (a microfilmed Australian patent application on file and open to public inspection at the Australian Patent Office and five sub-offices was sufficiently accessible); *Siemens-Elema AB v. Puritan-Bennett Corp.,* 13 U.S.P.Q.2d 1804, 1806, 1989 WL 200919 (S.D.Cal.1989), *aff'd,* 925 F.2d 1480 (Fed.Cir.1991) (a patent application held at a Swedish patent office was a printed publication even though "it was not published in a journal"). In contrast, three student theses, catalogued only by student name in a chemistry department library, were *not* sufficiently accessible because "the only research aid was the student's name, which, of course, bears no relationship to the subject of the student's thesis." *Cronyn,* 890 F.2d at 1160-61. *See also Application of Bayer,* 568 F.2d 1357, 1367 (C.C.P.A.1978) (holding that an uncatalogued thesis is not a § 102(b) publication).

Thus, although other factors are relevant, publications are generally sufficiently accessible if they are properly catalogued in a public library or database.[7] At least one case suggests that subject matter indexing is not required so long as an alternative research aid, such as an abstract, is availa-

---

[7] Judge Mayer, dissenting in *Cronyn,* de-emphasizes the significance of cataloging: "[t]he existence or nature of an indexing system is only one factor to be considered in assessing the public availability of a work; it is neither a necessary nor a sufficient condition for publication." *Cronyn,* 890 F.2d at 1161 (Mayer, J., Dissenting).

ble. *Mobil Oil Corp. v. Amoco Chemicals Corp.*, 779 F.Supp. 1429, 1489 (D.Del.1991), aff'd, 980 F.2d 742 (Fed.Cir.1992) (finding that abstracts, although "not an ideal system for retrieving information," may make a publication sufficiently accessible under § 102(b)).

(i) *Edison's Evidence of Accessibility.*

Through the U.S. Government. The Demmitt reference has been indexed and catalogued at the Energy Information Center of the U.S. Department of Energy and has been available to the general public since 1960. Morton Decl. ¶¶5-9. According to an Office of Scientific and Technical Information form, the Demmitt reference was catalogued under (1) "Oxygen — Reaction with Aqueous Hydrazine, Effects of Activated Carbon Catalysts", (2) "Hydrazine — Reaction with Oxygen in Aqueous Media, Effects of Activate Carbon Catalysts", and (3) "Carbon (Activated) — Use as a Catalyst for Oxygen-Hydrazine Reaction". Anderson Suppl. Decl. Exh. 1, at 8. Moreover, on August 26, 1960, Demmitt was distributed on microcard to contractors as well as to domestic and foreign libraries. *Id.* Exh. 1 at 3, 7.

Edison also submits evidence that the Demmitt reference was accessible to the public through the U.S. Department of Energy's "Nuclear Science Abstracts" (NSA), a publication listing U.S. Government reports which is available at many public libraries, including the library of the California Institute of Technology in Pasadena, California. Morton Decl. ¶¶5-6.[8] NSA listed the Demmitt abstract in 1960, albeit under the heading "General and Miscellaneous"

---

[8] According to a document called "Cumulative Report Index" published in 1966, the Demmitt Reference was available for $1.80 from OTS, a clearinghouse of the National Bureau of Standards of the U.S. Department of Commerce. Morton Dec. ¶7.

rather than under "Deoxygenation," "Degasification," or "Corrosion Reduction." Aitkin Decl. ¶8; Exh. 3 to Morton Decl.

Through Microcard at Public Libraries. Edison also presents evidence that the Demmitt reference was available prior to 1982 on microcard at Northwestern University's Seeley G. Mudd Library for Science and Engineering. Anderson Decl. Exh. 2. The microcard lists the detailed title "Preliminary Report on the Use of Activated Carbon as a Catalyst for the Dissolved Oxygen-Aqueous Hydrazine Reaction," suggesting that one would have been able to find the Demmitt reference by searching through the Seeley library's collection of Atomic Energy Commission microcards.

The same microcard has also been available since 1960 at both the University of California at Berkeley library and the Cleveland Public library. Anderson Decl.

Exh. 2.

(ii) *Ecolochem's Rebuttal Evidence.*

Ecolochem does not challenge Edison's evidence but instead attempts to identify several reasonably diligent interested persons who actually searched for prior art yet failed to find Demmitt. Although Edison argues to the contrary, such evidence is obviously relevant because it tends to make it more probable that the Demmitt reference could not, in fact, be found by interested, reasonably diligent persons ordinarily skilled in the art. F.R.Evid. 401. Nevertheless, because evidence of unsuccessful searches invites a time-consuming digression of only marginal probative value, this Court finds that such evidence is inadmissible under F.R.Evid. 403. Evaluating unsuccessful searches would require an expensive, distracting inquiry into the minutia of

library research.[9] Ultimately, this effort would create more smoke than light. Patent cases are already complex, time-consuming, and expensive, and this Court is loathe to make them unnecessarily more so.[10]

Nevertheless, Ecolochem contends that *HAll* requires this Court to embark upon this wasteful tangent. This Court disagrees. *HAll* affirmed a § 102(b) rejection based on a

---

[9] A court engaging in such an inquiry might have to ask: What exactly did the unsuccessful searcher seek? How thoroughly did he conduct his search? How many libraries must be searched for an effort to be considered diligent? Which libraries must be searched? Which search techniques should be used? How should a court evaluate the inevitable testimony of a library expert that an equally diligent search, conducted differently, would have disclosed the reference? How many unsuccessful searches are sufficient to rebut evidence of § 102(b) availability? Can evidence of unsuccessful searches be rebutted by evidence of successful searches? If yes, how should a court weigh the two?

[10] Federal Circuit case law emphasizes that parties asserting § 102(b) bars need not show that members of the public actually received the information, implicitly supporting this result. *See, e.g., Constant* 848 F.2d at 1569; *Wyer*, 655 F.2d at 226. *See also* 1 *Lipscomb's Walker on Patents* § 4:23 at 342 ("A printed publication capable of negativing novelty is anything that is printed and is distributed to any part of the public in any country without any injunction of secrecy . . . . Anything that is printed and made accessible to any part of the public is a printed publication."); *Friction Div. Products v. E.I. DuPont de Nemours & Co.*, 658 F.Supp. 998, 1008 (D.Del.1987), aff'd 883 F.2d 1027 (Fed.Cir.1989) ("Cataloging a paper in a technical or scientific library makes the publication sufficiently accessible to those interested in the art to satisfy the requirements of § 102(b)."). This result is also consistent with the standard of availability under § 102(a). *In re Carlson*, 983 F.2d 1032, 1037 (Fed.Cir.1992) ("We recognize that Geschmacksmuster on display for public view in remote cities in a far-away land may create a burden of discovery for one without the time, desire, or resources to journey there in person or by agent to observe that which was registered and protected under German law. Such a burden, however, is by law imposed upon the hypothetical person of ordinary skill in the art who is charged with knowledge of all the contents of the relevant prior art.").

dissertation catalogued in a single German University, relying on a declaration from the director of the library. Although the director was unable to give the exact date the dissertation was catalogued and shelved, he testified that, based on the library's usual procedures, the dissertation "most probably was available for general use toward the beginning of the month of December, 1977." *HAll*, 781 F.2d at 899. Because the critical date was three months later, the Court held the claims invalid.

As Ecolochem emphasizes, the Federal Circuit remarked that the director's testimony was "unrebutted." 781 F.2d at 900. Ecolochem mistakenly interprets this remark as a suggestion that the *HAll* applicant could have introduced rebuttal evidence of unsuccessful searches by *anyone*, including those seeking prior art *outside the German University library*. This Court believes that *HAll* sought only evidence to rebut the director's testimony regarding the date that the dissertation was indexed, catalogued, and shelved. For instance, a library employee might have testified that the dissertation was actually shelved three months, *after* the critical date. Similarly, another student or professor might have testified that he looked for the dissertation at the University library in late February 1978, but was told that it would not be shelved and accessible for another two weeks, *after* the critical date.

Such evidence is unlike the evidence Ecolochem attempts to introduce here. Ecolochem's evidence does not rebut Edison's claim that the microcards could be found at the Northwestern, Cleveland, or Berkeley libraries, or that the NSA abstracts were accessible. Rather, Ecolochem offers evidence that, despite the reference's presence in these locations, particular individuals looking for prior art failed to unearth it. Nothing in *Hall* suggests that this Court must admit such evidence. To do so would dilute § 102's high standard of diligence.

(iii) *Demmitt was Sufficiently Accessible Under § 102(b).*

"[W]here there are no disputed factual issues, the question [of] whether particular material is a 'printed publication' is a question of law." *Cronyn*, 890 F.2d at 1159.[11] Edison's evidence regarding availability through the United States Government, NSA, Northwestern, U.C. Berkeley, and the Cleveland Public Library is, therefore, undisputed, unrebutted, and, measured against the evidence accepted in Hall, unquestionably clear and convincing. Thus, this Court finds that the Demmitt reference was sufficiently accessible as a matter of law.

(b) *Does Demmitt Sufficiently Describe the Process?*

An anticipatory reference must not only be sufficiently accessible, but also describe the invention so that one of ordinary skill in the art can practice it. *See, e.g., Hall*, 781 F.2d at 899. Generally, "for prior art to anticipate under § 102 it has to meet every element of the claimed invention." *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1379 (Fed.Cir.1986), *cert. denied*, 480 U.S. 947, 107 S.Ct. 1606, 94 L.Ed.2d 792 (1987) (emphasis added). However, "[a]n anticipatory reference . . . need not duplicate word for word what is in the claims. Anticipation can occur when the claimed limitation is 'inherent' or otherwise implicit in the relevant reference." *Standard Havens Products, Inc. v. Gencor Indust., Inc.*, 953 F.2d 1360, 1369 (Fed.Cir.1991), *cert. denied*, 506 U.S. 817, 113 S.Ct. 60, 121 L.Ed.2d 28 (1992). *See also Akzo N.V. v. U.S. Int'l Trade Comm'n*, 808 F.2d 1471, 1479 (Fed.Cir.1986), *cert. denied*, 482 U.S. 909, 107 S.Ct. 2490, 96 L.Ed.2d 382 (1987); *In re King*, 801 F.2d 1324, 1326 (Fed.Cir.1986).

---

[11] Therefore, Rice's opinion that the Demmitt reference was not sufficiently accessible does not create a genuine issue of material fact.

The prior art need not have intended to achieve the same result as the claimed process, so long as the result was a necessary consequence of the process. *See, e.g., Verdegaal Bros., Inc. v. Union Oil Co.,* 814 F.2d 628, 633 (Fed.Cir.), cert. denied, 484 U.S. 827, 108 S.Ct. 95, 98 L.Ed.2d 56 (1987) (stating that defendant "did not have the additional burden of proving that [the prior art] recognized [all of the] capabilities" of the claimed process); *King,* 801 F.2d at 1326; *H.K. Regar & Sons v. Scott & Williams,* 63 F.2d 229, 231 (2d Cir.1933) (Learned Hand, J.) ("[W]hen the result is a necessary consequence of what was deliberately intended, it is irrelevant that it was then valueless for the purposes in mind."). *See also* Chisum, § 3.03 ("[A]nticipation is not avoided where the prior achievement was . . . a necessary consequence of what was intended, even though the achiever did not fully appreciate or recognize the . . . properties of the . . . process.").

Edison contends that the Demmitt reference discloses each and every step or element of '492 claims 1, 5, 6, 8, 9, 15 and 16 and '411 claim 21. Ecolochem concedes that the Demmitt reference invalidates '492 claims 8 and 9 and '411 claim 21, but argues that it does not sufficiently describe '492 claims 1, 5, 6, 15 and 16. Before addressing these contentions, this Court must interpret the relevant claims.

(i) *Claims That Require Dissolved Carbon Contaminant Removal — '492 claims 1, 5 and 6.*

Claim Interpretation. Claims 1, 5, and 6 of the '492 patent teach

A deoxygenation process comprising a first step of adding hydrazine to a liquid containing dissolved oxygen, a second step of passing said liquid through a bed of activated carbon to catalyze a reaction between said dissolved oxygen and said hydrazine whereby an amount of dissolved carbon contaminants are added to said liquid, and a third step of

passing said liquid through *an ion exchange resin selected from the group consisting of a mixed bed resin and cation resin to remove at least said dissolved contaminants.*

See, e.g., '492 claim 1 (emphasis added).[12] Unlike '411 claims 1-20, which specify a strong acid cation and a strong acid anion exchange resin, '492 claims 1, 5, and 6 specify "an ion exchange resin *selected from the group consisting of* a mixed bed resin and cation resin." Thus, these claims are "Markush claims", as they call for "material *selected from the group of x, y, and z*". Chisum § 8.06[2]; *Application of* Driscoll, 562 F.2d 1245, 1249 (C.C.P.A.1977); *Ex parte* Markush, 125 C.D. 126, 340 O.G. 839 (Comm'r Pat. 1924). By using Markush language, Ecolochem implicitly asserts that the members of the group are "alternatively usable for the purposes of the invention, and therefore, regardless of which of the alternatives is [used], the compound as a whole will exhibit the disclosed utility." *Driscoll,* 562 F.2d at 1249; *Application of Edwards,* 568 F.2d 1349, 1352 (C.C.P.A.1978); *Application of Skoll,* 523 F.2d 1392, 1397 (C.C.P.A.1975)

Ecolochem nonetheless asks this Court to give the claims the following interpretation: (1) "an amount of dissolved carbon contaminants" means cation and/or anion contaminants; (2) "to remove at least said dissolved contaminants" means to completely eliminate *all* of the dissolved carbon contaminants, including anionic contaminants;[13] and (3)

---

[12]The fifth claim teaches "[t]he process of claim 1, wherein, after said second step, an amount of unreacted hydrazine remains in said liquid, and wherein said unreacted hydrazine is removed in said third step." The sixth claim teaches "[t]he process of claim 1, wherein said liquid is water."

[13]This interpretation seems inconsistent with Ecolochem's interpretation of "deoxygenation". Ecolochem argues that to "remove" oxygen does not imply elimination, but that to "remove" carbon contaminants *does* imply elimination.

"selected from the group consisting of a mixed bed resin and cation resin" means that those practicing the invention must choose carefully between the resins, because although a mixed bed resin will remove essentially *all* ionic carbon contaminants, a cation resin will remove only cationic carbon contaminants. Rice Decl. Exh. 10 ¶5. In other words, Ecolochem appears to argue that it claims a third step which removes all ionic carbon contaminants by passing the liquid through an ion exchange mechanism which can be a cation resin if the activated carbon has only cation constituents, but must be a mixed bed resin if the activated carbon has anionic constituents. Usually, Ecolochem suggests, those practicing the invention will choose a mixed bed resin, because most activated carbons leach anionic, as well as cationic contaminants. Rice Decl. ¶9. Thus, Ecolochem argues that, notwithstanding the claims' Markush language, a mixed bed and a cation resin are not always "alternatively usable for the purposes of the invention." *Driscoll,* 562 F.2d at 1249.

This argument has no merit. Ordinarily, parties using Markush language cannot defeat challenges to validity by focusing on the *differences* between the members of a Markush group.

By the presentation of this Markush group, appellant has made a representation that for the purpose of the claimed invention the elements of the group are equivalents. Having made the representation . . . appellant may not now argue that these two elements are not equivalents.

Skoll, 523 F.2d at 1397.[14] Ecolochem neither addresses the Markush issue nor articulates any reason why this Court

---

[14] *In Skoll,* the Court of Customs and Patent Appeals found that two prior art references, read together, rendered one member of plaintiffs Markush claim obvious and thereby invalidated the entire claim. 523 F.2d at 1396-97. The *Skoll* plaintiff argued that the members of its

should not conclude that a mixed bed and a cation resin are equivalents for purposes of the invention. Nothing in the specification supports Ecolochem's interpretation or states that a cation resin cannot be chosen in combination with certain types of activated carbon — the specification states merely that "when the end use requires the removal of both hydrazine and [carbon] contaminants the use of a mixed bed is preferred," not required. '492 col. 5 (emphasis added).[15] Therefore, this Court rejects any interpretation of the claims which implies that a cation resin and mixed bed resin are not always alternatively usable for the purposes of the invention.

Claim interpretation thus becomes a straightforward exercise in logic. The claims do not limit the types of activated carbon which may be used, so those practicing the invention might use activated carbon that would leach both cationic and anionic contaminants. Because a cation resin removes only cationic, not anionic, carbon contaminants, the language "an amount of dissolved carbon contaminants are added to said liquid . . . and at least said dissolved contaminants [are removed]" has only two viable interpretations: (1) "an amount of dissolved carbon contaminants" refers to both cationic and anionic contaminants but "at least said dissolved contaminants [are removed]" refers to removal of

---

Markush group were not in fact equivalent, and that the non-obviousness of the non-preferred member of the Markush group should not invalidate the entire claim. The court disagreed.

[15]The specification's failure to describe when a cation resin can be used is telling. "[W]here an applicant undertakes to define his invention by the recitation of a Markush group, he must enable one skilled in the art to make and use at least one composition employing each member of the Markush group." *Application of Fouche*, 439 F.2d 1237, 1242 (C.C.P.A.1971). As Ecolochem believed that the skill in the art was "in need of improvement" and "modest" at best, *see infra*, this Court is surprised that Ecolochem expected one of ordinary skill to know when a cation resin could be used.

at least some of the contaminants (i.e., cationic contaminants); or (2) "an amount of dissolved carbon contaminants" refers only to cationic contaminants and "at least said dissolved contaminants [are removed]" refers to complete removal of the cationic contaminants. This Court need not choose between these two interpretations, because Demmitt anticipates in either case.[16]

Demmitt Anticipates '492 Claims 1, 5, and 6. Whether a reference discloses each element of the claim is a question of fact. *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1574 (Fed. Cir.1986). Ecolochem effectively concedes that Demmitt discloses the first two steps of '492 claims 1, 5, and 6. Thus, this Court need only review Ecolochem's Markush claim and determine whether Demmitt discloses the third step.

The novelty of a claim with a Markush group is determined as if the claim were generic. *See* Chisum § 8.06[2][f]. Consequently, "when . . . a claim covers several compositions, the claim is 'anticipated' if one of them is in the prior art." *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 782 (Fed.Cir.1985). *See also General Electric Co. v. Hoechst Celanese Corp.*, 740 F.Supp. 305, 313 (D.Del.1990) ("claim covering multiple chemical compositions [such as mixed beds and cation beds] . . . is anticipated if any one composition is disclosed by prior art"). Although Demmitt does not teach the use of a mixed bed, it indisputably discloses the use of a cation bed, which is unquestionably one of the compositions disclosed by Ecolochem's Markush group. Even though Demmitt did not discuss cation carbon contaminants, such contaminants are indisputably added when Demmitt is practiced, and are

---

[16] Rice's declaration does not preclude summary judgment on this issue. The meaning of those claims hinges on the significance of Markush language, not on the industry meaning of a term of art. See Howes, 814 F.2d at 643.

indisputably removed. *See* Smallwood Depo. at 254-62; Clifford Decl. ¶19. No reasonable jury could conclude otherwise; therefore, Demmitt anticipates '492 claims 1, 5, and 6 as a matter of law.[17]

(b) Claims That Require Substantially Complete Removal of Unreacted Hydrazine — '492 claims 15 and 16.

Claim Interpretation. Claims 15 and 16 of the '492 patent teach

A deoxygenation process comprising a first step of adding hydrazine to a liquid containing dissolved oxygen, a second step of passing said liquid though activated carbon to catalyze a reaction between said dissolved oxygen and said hydrazine, and a third step of substantially completely removing said hydrazine by passing said liquid through an ion exchange resin selected from the group consisting of mixed bed resin and cation resin to remove at least said dissolved contaminants.

---

[17] As a last-ditch defense, Ecolochem argues that Demmitt, which did not concern itself with carbon contaminants, cannot anticipate by "accident" or "unwitting duplication." Opposition at 10-11 (citing *Application of Marshall*, 578 F.2d 301, 304 (C.C.P.A.1978); *Application of Felton*, 484 F.2d 495, 499-500 (C.C.P.A.1973)). As Ecolochem notes, Demmitt was concerned simply with removing excess hydrazine in order to measure oxygen levels using the Winkler method, not with removing carbon contaminants. Thus, Ecolochem argues, Demmitt does not anticipate.

Ecolochem misunderstands the meaning of accident. A true accident is not reproducible. *See*, e.g., Chisum § 3.03. Demmitt's "accidental" removal of cation contaminants is, as even Ecolochem appears to concede, a natural and necessary consequence of using a cation exchange resin. *See, e.g., King*, 801 F.2d at 1326; *H.K. Regar & Sons*, 63 F.2d at 231.

See, e.g., '492 patent claim 15 (emphasis added).[18] Ecolochem maintains that "substantially complete" removal means removal to a level of less than one part per billion ("ppb"), citing '492 Patent Example 1.

Edison neither challenges Ecolochem's right to "be [its] own lexicographer" nor attacks its chosen definition. *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540 (Fed.Cir.1983), cert. denied, 469 U.S. 851, 105 S.Ct. 172, 83 L.Ed.2d 107 (1984). Therefore, this Court assumes that "substantially complete" removal of hydrazine means removal to a level of less than one ppb.

Summary Judgment is Inappropriate on '492 Claims 15 and 16. Whether Demmitt "substantially completely" removes excess hydrazine is a question of fact. *Hybritech Inc.*, 802 F.2d at 1379. Edison is entitled to summary judgment only if it demonstrates that a reasonable trier of fact *must* find by clear and convincing evidence that Demmitt either inherently or explicitly removes hydrazine to levels of less than one ppb. Edison fails to meet this burden. Its evidence consists of two statements: (1) Demmitt's remark that "[t]he purpose of this [cation] resin was to remove the residual hydrazine;" and (2) Ecolochem's concession that "[i]t is entirely possible and indeed likely that Demmitt achieved the substantially complete removal of hydrazine as taught by Ecolochem." Morton Decl., Exh. 2 at 3.

While the Demmitt reference indisputably discloses "removal" of hydrazine, it focused on removing hydrazine only to the extent necessary to use the Winkler method — up to one-hundred ppb. Rice Decl. Exh. 10 ¶11. Demmitt does not state that the cation resin removed hydrazine to less than one ppb. Thus, Demmitt does not expressly anticipate

---

[18] Claim 16 teaches "[t]he process of claim 15, wherein said liquid is water."

'492 claims 15 and 16. Moreover, Ecolochem's concession that "[i]t is entirely possible and indeed likely that Demmitt achieved the substantially complete removal of hydrazine as taught by Ecolochem," does not establish that Demmitt *inherently* anticipates the claims. Edison must present evidence that a reasonable trier of fact would *necessarily* find *clear and convincing*. These luke-warm statements do not suffice, and Edison does not present any expert testimony that Demmitt necessarily, or in its "normal and useful operation" reduces hydrazine to levels less than one ppb. *King*, 801 F.2d at 1327. *Cf. Akzo N.V.*, 808 F.2d at 1479 (stating that "concentrated sulfuric acid is not inherently 98% sulfuric acid to one skilled in the art" where the claim called for 98% sulfuric acid and the reference called for concentrated sulfuric acid). Therefore, Edison's motion for summary judgment on '492 claims 15 and 16 is hereby DENIED.

2. *NON-OBVIOUSNESS*

Under 35 U.S.C. § 103, A patent is invalid "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art . . ."

Obviousness is a legal conclusion based upon four factual inquiries: (a) the scope and content of the prior art; (b) the differences between the prior art and the claimed invention; (c) the level of ordinary skill at the time the invention was made; and (d) objective evidence of secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17, 86 S.Ct. 684, 693-94, 15 L.Ed.2d 545 (1966); *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1270 (Fed.Cir.1991); *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve Inc.*, 796 F.2d 443, 447 (Fed.Cir.1986), *cert. denied*, 484 U.S. 823, 108 S.Ct. 85, 98 L.Ed.2d 47 (1987).

So long as a court views all factual disputes regarding these factors in the light most favorable to the patentee, it may weigh the factors and grant summary judgment of invalidity. *See Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 719 (Fed.Cir.1991) (holding that, on a motion for summary judgment, district court may "weigh all considerations, primary and secondary" and conclude that secondary considerations do "not carry sufficient weight to override a determination of obviousness based on primary considerations."); *Newell Cos. v. Kenney Mfg. Co.*, 864 F.2d 757, 768 (Fed.Cir.1988), cert. denied, 493 U.S. 814, 110 S.Ct. 62, 107 L.Ed.2d 30 (1989); *Foster v. Hallco Mfg. Co.*, 22 U.S.P.Q.2d 1351, 1357, 1991 WL 340568 (D.Or.1991).

Mobile Water analyzed these factors, and found the '492 patent valid. The case is highly persuasive on issues for which the evidence has not changed, although it is not binding. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d. 1561, 1564 (Fed.Cir.) *cert. denied*, 481 U.S. 1052, 107 S.Ct. 2187, 95 L.Ed.2d 843 (1987) ("A trial court is required by Congress, 35 U.S.C. § 282 . . . to say only whether the patent challenger has carried its burden of establishing invalidity in the particular case before the court . . . [If the patent challenger fails to do so,] the patent simply remains valid until another challenger carries the § 282 burden.").

However, *Mobile Water* is entitled to little weight, if any, on issues for which new evidence is presented. *See Multi-Tech Sys., Inc. v. Hayes Microcomputer Products, Inc.*, 800 F.Supp. 825, 838 (D.Minn.1992).

(a) *Scope and Content of the Prior Art.*

Edison presents the Houghton reference, which discloses the first two steps of Ecolochem's process,[19] and the Marti-

---

[19] See Houghton & Cuerdon, *The Use of Active Carbon with Hydrazine in the Treatment of Boiler Feed Water, Int'l* Water Conference, Bournemouth, England pp. 54-58 (1957).

nola[20] and Bechtel[21] publications, which "recognize the potential of the Houghton process and caution that the use of activated carbon may release impurities into the effluent." *Mobile Water*, 690 F.Supp. at 783. Edison also presents the Hassler reference[22] and the Hegde patent,[23] which reveal that some forms of activated carbon give off ionic contaminants and that an ion-exchange resin can remove these contaminants. Each of these references was before the *Mobile Water* court. However, neither the *Mobile Water* court nor the patent examiner had the Demmitt reference.[24] Demmitt tested the Houghton process by injecting hydrazine into oxygenated water and running the water over a bed of activated carbon, which catalyzed the hydrazine/oxygen reaction. Because hydrazine interfered with Demmitt's test for measuring oxygen levels (the Winkler method), Demmitt added a cation exchange column to reduce hydrazine levels in a test sample.

---

[20] Martinola, et al., "Saving Energy by Catalytic Reduction of Oxygen in Feedwater" in *Proceedings 41st Int'l Water Conference, Eng'g Soc'y of Western Penn.* 77-83 (1980).

[21] Bechtel Group, Inc., *Guide to the Design of Secondary Systems and their Components to Minimize Oxygen Induced Corrosion* (1982).

[22] J.W. Hassler, *Purification with Activated Carbon 51* (1974) ("In general, the use of the ion-exchanger should follow the treatment with carbon, especially if the carbon contains any appreciable amount of inorganic compounds.").

[23] The Hegde patent notes: Activated carbons contain ionic impurities, and occasionally collect microorganisms, which are released into the water. They are therefore normally used prior to treatment of the water with mixed ion exchange resins which remove the ions released. Hegde, Patent No. 4,430,266 co. 1:37-41.

[24] Because Demmitt is considered prior art for § 102(b) purposes, it is also prior art for § 103 purposes. *See, e.g., Hodosh v. Block Drug Co.*, 786 F.2d 1136, 1142 (Fed.Cir.), *cert. denied*, 479 U.S. 827, 107 S.Ct. 106, 93 L.Ed.2d 55 (1986) (criticizing the district court for applying different standards for § 102 and § 103).

Demmitt also discussed using deoxygenated water in power plants, noting that the Houghton process "would be useful in high temperature reactors." Demmitt at 2. By 1982, other prior art, including the Bechtel reference, discussed this application. '411 File Wrapper at 4 ("It would have been obvious to one of ordinary skill in the art to . . . employ this deoxygenated stream in a power-generating apparatus, as suggested by the Bechtel publication.") (Statement of the Patent Examiner).

Thus, the scope and content of the prior art before this Court can be described roughly as follows:

(i) The Houghton reference, which disclosed using a bed of activated carbon to catalyze the oxygen/hydrazine reaction;

(ii) Martinola and Bechtel, which recognized that the Houghton process had potential as a method for deoxygenation, but warned that activated carbon would release carbon contaminants;

(iii) Hassler and the Hegde patent, which recognized that activated carbons release ionic impurities into the water, and noted that ion exchange resins would remove these impurities;

(iv) Demmitt, which added a cation exchange resin to the end of the Houghton process to facilitate the Winkler measurements; and

(v) Bechtel and Demmitt, which recognized that the deoxygenated stream would be useful in power-generation systems.

(b) *The Differences Between the Prior Art and the Claimed Invention.*

Ecolochem claims an "invention resid[ing] in the *combination* of very old and well-known components." Opp. at 32.

It admits that prior art "taught the Houghton process, that carbon leaches contaminants, that ion exchange resins would remove hydrazine, and the use of ion exchange resins downstream of activated carbon [to remove ionic carbon contaminants]." However, it contends that none of the prior art put all of these elements together.

(c) *Level of Skill in the Art.*

Courts determine the level of skill in the art by evaluating the educational background of the inventors, the educational level of those in the industry, and the sophistication of the technology involved. *Ryko*, 950 F.2d at 718. The *Mobile Water* court concluded that the "level of *ordinary* skill in the art is . . . modest," although "[t]here exists a core of individuals with a high level of formal scientific education who keep abreast of developments in the art." 690 F.Supp. at 784. As *Mobile Water*, Ecolochem characterizes the level of skill as "in need of improvement," declining to define the issue more precisely.

Edison argues that this "in need of improvement" testimony is a complete failure of proof.[25] Relying on evidence allegedly not presented in *Mobile Water*, it asks the Court to disregard *Mobile Water* and reject Edison's definition. Although this Court agrees that Ecolochem's "in need of improvement" testimony is itself in need of improvement,

---

[25] Edison contends that a person of ordinary skill in the art would have at least a bachelor's degree in chemistry, would have worked in the industry for several years, and would have periodically attended industry conferences. As Edison notes, named co-inventor William S. Miller has a B.S. in chemistry, and has worked in the field for twenty-six years. Miller Depo. at 17-19. His co-inventor, Richard C. Dickerson, attended college for four years and has worked in the water treatment field for thirty years. Trial Tran. of *Ecolochem, Inc. v. Mobile Water Co.* (Feb. 2-3, 1988), at 91-92. Peter S. Meyers, the technical manager of the company supplying Edison's accused process, majored in chemistry and has worked for nineteen years in the water treatment field.

this Court chooses to defer to *Mobile Water* at this early stage in the case. Therefore, for purposes of this summary judgment motion, this Court will assume that the level of skill in the art was "modest" at best.

(d) *Objective Evidence of Secondary Considerations.*

Secondary considerations, such as commercial success, long felt but unresolved needs, and failed attempts, may indicate that an invention is non-obvious. *See, e.g., Bausch & Lomb,* 796 F.2d at 450. As in *Mobile Water,* Ecolochem presents considerable evidence that the invention was a commercial success, had a great impact on the industry, and satisfied a long- felt need. See Mobile Water, 690 F.Supp. at 784-85.[26]

Edison counters that this evidence does not prove that anyone unsuccessfully attempted to develop the invention.[27]

---

[26] Specifically, Ecolochem presents evidence suggesting that the industry has desired deoxygenated water without contaminants for years, yet failed to create Ecolochem's invention. Florida Power & Light, "despite knowledge of [the] Houghton [process]," and a need for a clean deoxygenation process, allegedly failed to develop the invention and instead purchased a license from Ecolochem. Edison itself also allegedly failed, as did the Bechtel Group, Ecolochem's major competitors and several chemical suppliers. Opp. at 43-44. Moreover, Ecolochem also argues that the invention has been well-received by the entire industry, including Edison. Ecolochem's sales allegedly have jumped tenfold since it began marketing the patented process. Such success, Ecolochem maintains, "infers [sic] that many before had tried but failed to make Ecolochem's invention." *Id.* at 57.

[27] Edison argues that Ecolochem presents little more than the opinion of its expert, James Rice, who had not even heard of the Houghton process before *Mobile Water.* Furthermore, Edison notes that the prosecution history does not mention a long-felt need to rectify the problem of carbon contaminants, a fact which Edison finds curious in light of the patent's allegedly difficult prosecution history — the patents were initially completely rejected by the patent examiner, '492 File Wrapper Paper No. 4, then rejected in part, *id.,* Paper No. 8, before they

Edison's arguments are little more than invitations to weigh Ecolochem's evidence, and attacks on its credibility. On a motion for summary judgement, this Court must view the evidence in the light most favorable to Ecolochem, and assume that this evidence proves commercial success, long-felt but unresolved need, and the other secondary considerations.

(e) *Obviousness — Legal Conclusion.*

Because "[o]bviousness is a legal conclusion based on factual determinations and not a factual determination itself", *Aktiebolaget Karlstads Mekaniska Werkstad v. United States Int'l Trade Comm'n,* 705 F.2d 1565, 1575 (Fed.Cir.1983), this Court may weigh the four factual factors and, if proper, grant summary judgment of invalidity so long as there are no genuine issues of material fact as to the factors themselves. *See, e.g., Ryko,* 950 F.2d at 719.

In weighing these factors, this Court must determine whether the prior art provides *"some teaching, suggestion, or incentive to make the combination* made by the inventor." *Northern Telecom, Inc. v. Datapoint Corp.,* 908 F.2d 931, 934 (Fed.Cir.1990), *cert. denied,* 498 U.S. 920, 111 S.Ct. 296, 112 L.Ed.2d 250 (1990) (emphasis added). *See also Texas Instruments, Inc. v. U.S. Int'l Trade Comm'n,* 988 F.2d 1165, 1178 (Fed.Cir.1993); In re Jones, 958 F.2d 347, 351 (Fed.Cir.1992); *In re Mills,* 916 F.2d 680, 682 (Fed.Cir.1990); Mobile Water, 690 F.Supp. at 783.[28] The

---

were finally approved. *See Phillips Elec. & Pharmaceutical Indus. Corp. v. Thermal & Elec. Indus. Inc., 450 F.*2d 1164, 1175 (3d Cir.1971) ("long and tortuous course in the patent office militates against validity.).

[28] Consequently, this Court must view each of Ecolochem's claims "as a whole." *W.L. Gore & Assoc. v. Garlock, Inc.,* 721 F.2d 1540, 1548 (Fed.Cir.1983) ("A court's restriction of a claimed multi-step process to one step constitutes error, [if] done . . . at the behest of an accused

suggestion to make the combination need not be explicit, so long as it "may be fairly inferred from" a prior art reference. *In re Gorman,* 933 F.2d 982, 986-87 (Fed.Cir.1991). *See also In re Nilssen,* 851 F.2d 1401, 1403 (Fed.Cir.1988).

Finally, although the suggestion in the prior art must be obvious to a person of ordinary skill in the art, the hypothetical person of ordinary skill "is presumed to know all the pertinent prior art, whether or not the applicant [was] actually aware of its existence." *In re Carlson,* 983 F.2d 1032, 1038 (Fed.Cir.1992) (emphasis added); *see also Nilssen,* 851 F.2d at 1403; Chisum § 5.04[1] ("[H]e is presumed to have perfect knowledge of all the pertinent prior art — however obscure its source.").

'411 Claim 20. Claim 20 of the '411 patent describes:

A deoxygenation process comprising a first step of contacting a liquid containing dissolved oxygen and hydrazine with a bed of activated carbon to catalyze a reaction between said dissolved oxygen and said hydrazine, whereby an amount of dissolved carbon contaminants is added to said liquid, and a second step of removing at least said dissolved contaminants by passing said liquid through a strong cation exchange resin and a strong base anion resin.

The first step, passing liquid containing hydrazine over a bed of activated carbon, is the Houghton process. A person of even modest skill would recognize that passing the liquid over the carbon bed would add ionic impurities. Martinola; Bechtel. Moreover, a person of modest skill would have recognized that an ion exchange resin would remove ionic impurities, and that by passing a liquid through both a cation and an anion resin, one could remove both cationic and anionic carbon contaminants. See Hassler; Hedge.

---

infringer relying on that restriction to establish invalidity by showing that one step in a prior act process otherwise distinct.").

Although Houghton, Bechtel, Martinola, Hegde, and Hassler together describe each element of the process, the *Mobile Water* court concluded that a person of modest skill would not have understood the suggestion to combine these elements. 690 F.Supp. at 786. Accepting this conclusion, this Court must deny Edison's motion, unless prior art presented to this Court is *more* suggestive than that presented in *Mobile Water.*

The *Mobile Water* court focused on Martinola and Bechtel, noting that "[n]othing in the Martinola reference . . . teaches the use of an . . . ion exchange resin following the hydrazine/carbon process." *Mobile Water,* 690 F.Supp. at 782. The Bechtel publication, on the other hand, "refer[s] to the use of ion-exchange resins in the secondary system of the power generating plant," *Mobile Water,* 690 F.Supp. at 782, and thus might suggest the combination to one expert in the art. Id. at 786. However, any suggestion to make the combination is quite subtle, and obscured by Bechtel's dense, challenging prose. While an expert, reading Bechtel, might make the connection, one of modest skill in the art would not. *Mobile Water,* 690 F.Supp. at 786.

In contrast, Demmitt suggests the combination clearly. In straightforward prose and a simple diagram, Demmitt suggests that adding an ion exchange resin to the end of the Houghton process will remove impurities in the effluent. Nevertheless, Ecolochem contends that Demmitt did not suggest the combination, emphasizing that Demmitt (1) focused on hydrazine removal, not carbon contaminants, (2) did not intend to use the resin as part of full-scale process, and (3) only sent a portion of the effluent — the test stream — over the cation resin.

None of these factors would have obscured Demmitt's suggestion. In light of the extensive prior art, one of modest skill would have required only a suggestion to combine Houghton and an ion exchange resin to remove impuri-

ties[29] — the other prior art would have informed even one of modest skill that ion exchange resins would remove ionic carbon contaminants as well as hydrazine.[30] Similarly, a person of even modest skill would not have been distracted by Demmitt's scale or purpose. Demmitt's suggestion was clear: Use an ion exchange resin at the end of the Houghton process and your effluent will be more pure. *Cf.* Chisum § 5.04[5] (noting that courts often find inventions which are merely enlarged versions of previous inventions to be obvious).

Nevertheless, Ecolochem contends that even if this Court find Demmitt to be suggestive, "the secondary factors impel a conclusion that the '492 patent was not obvious." *Mobile Water,* 690 F.Supp. at 786 n. 9. This Court disagrees. Secondary considerations carry little weight where a critical prior art reference has long been neglected. *See Graham,* 383 U.S. at 36, 86 S.Ct. at 703 (declaring patent invalid as obvious notwithstanding alleged failure by others, noting that "[i]t is irrelevant that no one apparently chose to avail himself of knowledge stored in the patent office and readily available.").[31] In the instant case, the person of ordinary skill in the industry does not possess a broad knowledge of developments in the art. *Mobile Water,* 690 F.Supp. at 784 ("Likewise, the experts, (presumably persons who would be

---

[29] The '411 patent itself grouped carbon contaminants and excess hydrazine together as "impurities." '411 patent col. 1.

[30] Although Demmitt used a cation exchange resin, instead of a mixed bed or both cation and anion exchange resins, the prior art suggested which type of resin to use.

[31] *See also Manufacturers Sys., Inc. v. ADM Indus., Inc.,* 198 U.S.P.Q.223, 1978 WL 21428 (N.D.Ind.1978), *aff'd.* 615 F.2d 741 (7th Cir.1979); Chisum, §5.04[1] ("[T]he presumption [of perfect knowledge of prior art] dilutes . . . evidence of prior failures in the art — since [such failures] are often predicated on less-than-perfect knowledge of the prior art.").

included among the most highly skilled in the art) who were called at trial were unaware of the Houghton process until retained by the parties in this litigation."). Moreover, Ecolochem concedes, and indeed even emphasizes, that no one in the art searching for a solution to the deoxygenation problem found Demmitt. Rather than indicate that the invention is non-obvious, the secondary considerations merely reemphasize that no one consulted Demmitt. In short, the industry may not have been so much in need of improved inventions, as it was in need of better research.

Unfortunately for Ecolochem, "[i]n order to discourage wasteful or duplicative original inventive activity, the patent laws impose an absolute duty to research the entire pertinent prior art for a solution to a problem at hand." Chisum § 5.04[1]. Ecolochem's evidence of secondary considerations, therefore, does not outweigh Demmitt and render the claims non-obvious. *Foster,* 22 U.S.P.Q.2d at 1357, 1991 WL 340568. Edison has overcome the presumption of validity by clear and convincing evidence, and has proven that a person of modest skill in the art, armed with Demmitt and the other prior art references, would have found '411 claim 20 obvious.[32]

'492 Claims 7 and 10. Because '411 claim 20 is obvious in light of Demmitt, '492 claims 7 and 10 are clearly obvious as well. '492 claim 7 depends on claim 6, which the Demmitt reference anticipates, and adds only a "final step of circulating said deoxygenated water at elevated temperatures in a

---

[32]This Court has reviewed Rice's declaration, which states that the claims are not obvious. However, "an expert's opinion on the legal conclusion of obviousness is neither necessary or controlling." *Avia Group Int'l v. L.A. Gear California, Inc.*, 853 F.2d 1557, 1564 (Fed.Cir.1988). *See also Nutrition 21 v. United States,* 930 F.2d 867, 871 n. 2 (Fed.Cir.1991). Thus, such declarations do not preclude summary judgment. *Cable Electric. Products, Inc. v. Genmark, Inc.*, 770 F.2d 1015, 1025 (Fed.Cir.1985).

power-generating apparatus." '492 col. 8:31-33. Similarly, claim 10 depends on claim 9, which Demmitt also anticipates; claim 10 adds only a "final step of circulating said deoxygenated water at elevated temperatures in a power-generating apparatus." '492 col. 8:46-48.

The prior art clearly suggests using a deoxygenated stream in a power generator. *See* Demmitt at 2; '411 File Wrapper at 4 publication.). Keeping in mind that claims must be considered as a whole, this Court finds that '492 claims 7 and 10 are invalid as obvious.

III. Summary

Ecolochem's effort may have benefitted society and the power generation industry. A seventeen-year monopoly, however, is too high a price to pay for an invention which would have been obvious to anyone availing themselves to the full scope of the prior art. *See Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 282, 96 S.Ct. 1532, 1537-38, 47 L.Ed.2d 784 (1976) ("Though doubtless a matter of great convenience, producing a desired result in a cheaper and faster way, and enjoying commercial success, [the invention] did not produce a 'new or different function' . . . within the test of validity of combination patents."). Therefore, this Court finds as follows:

1. The meaning of "deoxygenation process" presents a genuine issue of material fact precluding summary judgment of non-infringement of all claims.

2. Edison has presented clear and convincing evidence that the Demmitt reference was sufficiently accessible for §102 and §103 purposes.

3. Ecolochem's evidence of unsuccessful searches, though relevant, is inadmissible under F.R.Evid. 403.

4. Demmitt anticipates claims 8 and 9 of the '492 patent and claim 21 of the '411 patent.

5. Although Demmitt does not teach the use of a mixed bed, it indisputably discloses the use of a cation resin. Thus, Demmitt anticipates '492 claims 1, 5, and 6.

6. At best, Edison offers only thin evidence that Demmitt reaches hydrazine levels of less than 1 ppb. A reasonable trier of fact would not necessarily find this evidence clear and convincing — thus, whether Demmitt in fact reaches these hydrazine levels is a genuine issue of material fact precluding summary judgment of invalidity due to anticipation on '492 claims 15 and 16.

7. Demmitt anticipates '492 claim 2.

8. The prior art renders '411 claim 20, and '492 claims 7 and 10 invalid as obvious.

IT IS SO ORDERED.

Appendix E

APPENDIX E

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

ORDER

A combined petition for panel rehearing and suggestion for rehearing en banc having been filed by the APPELLEE, and a response thereto having been invited by the court and filed by the APPELLANT, and the petition for rehearing having been referred to the panel that heard the appeal, and thereafter the suggestion for rehearing en banc and response having been referred to the circuit judges who are in regular active service,

UPON CONSIDERATION THEREOF, it is

ORDERED that the petition for the panel rehearing be, and the same hereby is, DENIED and it is further

ORDERED that the suggestion for rehearing en banc be, and the same hereby is, DECLINED.

The mandate of the court will issue on December 20, 2000.

FOR THE COURT,

Jan Horbaly
Clerk

Dated: December 13, 2000
cc: Clifton E. McCann
Gregory P. Stone

FILED
U.S. COURT OF APPEALS
FOR
THE FEDERAL CIRCUIT
DEC 13 2000
JAN HORBALY
CLERK

ECOLOCHEM V
SOUTHERN CALIF EDISON,
99-0143
(DCT - 92-CV3436)

Note: Pursuant to Fed. Cir. R. 47.6, this order is not citable as precedent. It is a public record.